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Florida Pulp & Paper Co. Starts New Kraft Paper Mill at Pensacola, Fla.

By R. G. Seip, Chief Engineer, Florida Pulp & Paper Co.

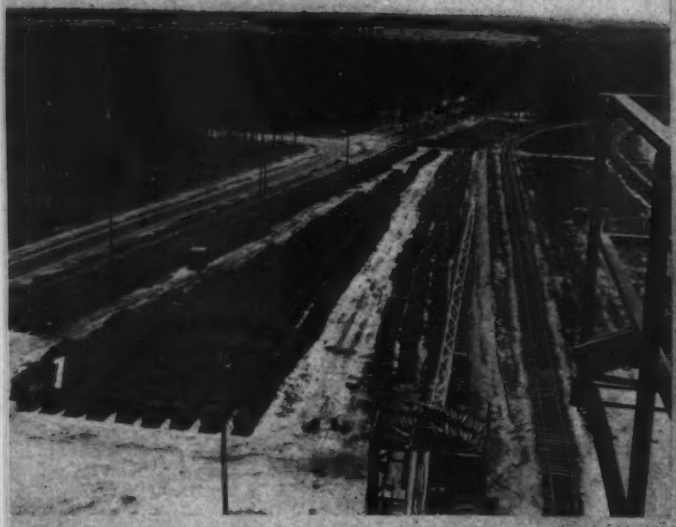
The new pulp and paper mill of the Florida Pulp and Paper Company started operations and manufacture of paper in August and has since been commercially producing increasing capacities of very acceptable grades of kraft papers. This plant is located at Cantonment, Florida, fifteen miles north of Pensacola on the St. Louis and San Francisco Railroad.

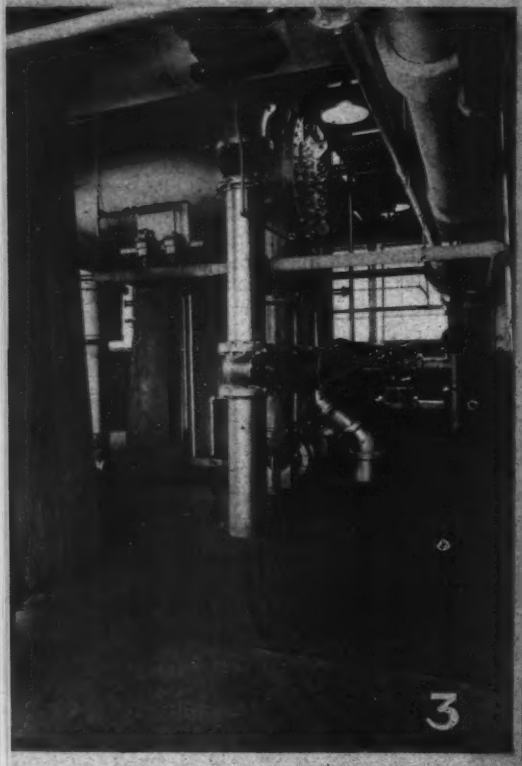
The story of the Florida Pulp and Paper Company is fundamentally a story of forest development. Led by J. H. Allen, formerly associated with the Union Bag and Paper Company of Savannah, Ga., also identified with a number of the pulp and paper mills in the South and who has always worked actively and earnestly for the development of the southern pulp and paper industry and for an intelligent forest conservation program, his colleagues and the men of the Florida Pulp and Paper Company believe that the object of a paper mill is not only to make paper but to process and find a market for forest products, to utilize, conserve and develop the raw material resources — the forest lands—in such a way as to insure the future both of the industry and of the forests. From a tract of more than 100,000 acres of the very finest long leaf yellow pine lands in Escambia and Santa Rosa counties, purchased by J. G. Pace and his associates in 1904, 90,000 acres are owned today by the Florida Pulp and Paper Company.

General View Florida Pulp & Paper Co.

In 1905 the original purchasers with others formed a company and incorporated under the name of Escambia Land and Manufacturing Company. Vast lumber and turpentine operations were carried on by this company until 1911 when J. G. Pace and his brother, J. H. Pace, bought out all of the stock holders of the company paying them double the cost of their investments and took the operations in their own hands. Where the lumber mills had removed the yellow pine timber from large areas, scattered throughout their holdings, Mr. Pace began a development along agricultural lines. New farms were opened up, blooded cattle introduced, general farming operations were financed and carried on with the result that 10,000 acres of the original purchase have been developed into fine farms owned and occupied by contented families with good roads, schools and churches.

Mr. Pace was always a keen student of forestry and taught forestry to his sons and the men in his employ. The result





INSTALLATIONS IN MILL OF FLORIDA PULP AND PAPER CO.

PENSACOLA, FLA.

1. Wood Yard—View from Top of Chip Ben.

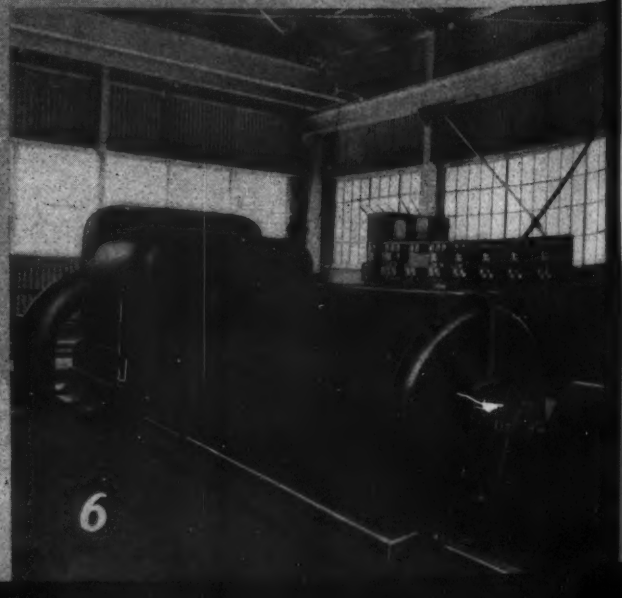
2. Evaporator and Recovery Buildings Boiler House and Turbine Room at Right.

3. Power Plant—Condenser and Water Supply Control.

4. Evaporator Room—SWENSON Quadruple Effect Evaporators.

5. Portion of Wood Yard in Foreground, Causticizing Plant at Left, Barking Drum and Conveying System, Center Wood Room and Digester Building at Right.

6. Power Plant—3500 KW Double Extraction Condensing Turbine Generator — WESTINGHOUSE and 2300 Volt Feeder Distribution Panels.



of this practice today is clearly seen in the fine stand of young timber of second growth come back on the lands since the first growth was taken out and the Florida Pulp and Paper Company is the proud owner of one of the finest tracts of young timber in the entire South. In addition to the 90,000 acres of timber lands in Santa Rosa County, the company also owns 35,000 acres of timber land in Escambia County.

It is conservatively estimated that the timber owned outright by the company will raise six-tenths of a cord per year per acre which would make seventy-five thousand cords of wood annually. Fourty-four thousand tons of bleached sulphate paper could be made from the wood taken out of these tree farms every year indefinitely. The plant at present will utilize sufficient wood to make about thirty thousand tons per year. With reasonable fire protection, selective cutting practice, and good forest management, a perpetual supply of wood for this mill is assured.

Ground was broken for the construction of the plant in August 1940 and completed for the actual manufacture of paper in August 1941. Conceived and constructed under the direction of experienced men, each a specialist in his class and long identified with the southern pulp and paper industry, the plant and equipment when completed had the further advantage and benefit of the direction of its initial operation and manufacture of paper by E. H. Mayo, pioneer maker of kraft paper, and engaged in its manufacture in its various forms for a number of years.

As a result of this coordinated and cooperative experience provided, records were broken in the first effort to make paper on the new Black-Clawson machine on the night of August 19, 1941, when E. H. Mayo opened the gate valve to the head box of the machine at 7:51 P.M. and in nine minutes, at exactly eight, had a well formed sheet of paper going on the reel. The machine continued to run all night after that without a break and producing good and saleable paper. It has been running consistently continuous since then and producing all weights of kraft papers.

Staff of the Company

An unusual staff has been assembled for the management and direction of the Florida Pulp and Paper Company and contains a number of names well known in the southern pulp and paper industry. The list of officers and department executives follows:

James H. Allen, president and general manager; A. D. Pace, vice-president and treasurer; J. C. Pace, vice-president and secretary; J. McHenry Jones, director and general counsel; H. Hilton-Green, director in charge of traffic; G. T. Wegner, comptroller and assistant secretary; R. G. Seip, chief engineer; E. H. Mayo, consulting executive for operations; G. M. Snyder, plant manager; Paul Hodges, pulp mill superintendent; V. J. Westbrook, assistant pulp mill superintendent; George Engert, paper mill superintendent; A. J. Navarre, assistant paper mill superintendent; A. F. Downey, assistant paper mill superintendent; G. R. Dubus, master mechanic; H. L. McLeroy, plant engineer; G. Hutchinson, civil engineer and timber survey.

The Plant

With a background of more than twenty years of experience in the design and engineering for pulp and paper mills from association with consulting organizations of Joseph H. Wallace and Co., and Hardy S. Ferguson and Co., and identified particularly on the engineering of projects for such southern pulp and paper mills as Hummel-Ross Fibre Corporation, Cherry River Paper Company, The Champion Paper and Fibre Company, The Chesapeake Corporation and Crossett Paper Mills—the chief engineer for the Florida Pulp and Paper Company, Russell G. Seip, developed the general design and arrangement of the plant and personally supervised the preparation of the detail design and the construction and installation required. The entire project and mill design has had the further benefit of the review and advice of Hardy S. Ferguson, Consulting Engineer. The construction of the buildings and installation of equipment was done by the Rust Engineering Company of Pittsburgh, Pa., under the supervision of their field superintendent, T. V. Radcliffe.

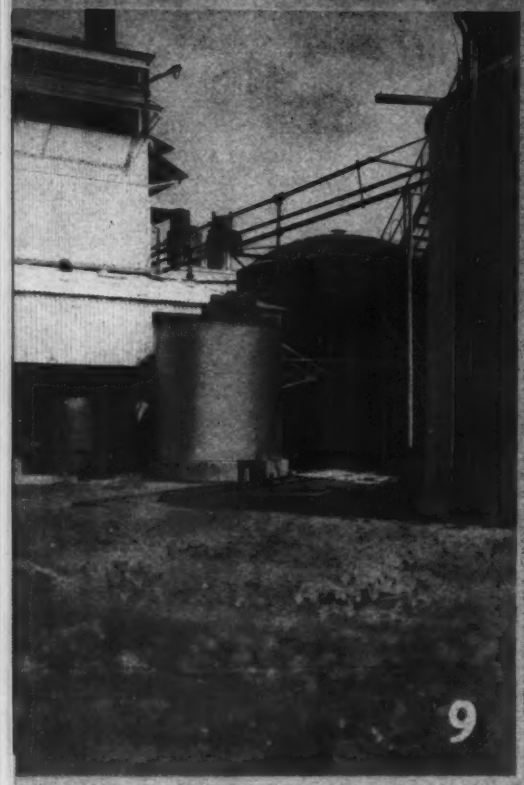
The mill was designed for a capacity of 60 tons daily of high white sulphate paper and has produced since the beginning of operation as much as 94 tons of natural sulphate board in a single day of twenty-four hours. With but little added equipment to overcome the one or two limiting conditions it is possible to assure a production of 100 tons daily of natural sulphate bag and wrapping papers.

Constructed for a straight line operation, the plant buildings are of steel frame with corrugated transite siding, arranged in two groups parallel with each other and extending in a north and south direction, parallel with the main line track of the St. Louis and San Francisco Railroad. These two groups of buildings are separated longitudinally by the two service tracks connecting to the main line of the San Frisco Railroad. The group of buildings on the East side of these service tracks comprise the paper mill, bleaching plant, pulp mill and wood preparation plant, while the group of buildings on the west side of these tracks comprise the power house, boiler house, chemical recovery and liquor making plant. Provision has been made in the arrangement and grouping of buildings to provide space for the extension of each individual plant unit for any increase in plant capacity.

Wood Handling

The principal supply of pulpwood is delivered to the mill by trucks to a wood yard 500 feet long by 150 feet average width located beyond the southerly end of the pulp mill group of buildings, providing a storage for more than 2000 cords of pulpwood. Pulpwood logs are unloaded direct from the trucks by a tractor crane which deposits them on a high timber platform at the head of the barking drum, from which they are fed into the drum. A timber ramp and unloading platform is also provided along one side of the barking drum for emergency use where trucks can unload logs direct into the return conveyor carrying them up to the drum. An unloading track branching from the service track connection to the railroad provides for the handling of pulpwood received from points beyond economical truck haul. Later a conveyor arrangement is to be installed along side of this track to provide for feeding the Barking drum direct from cars as well as trucks and from storage yard.

A barking drum 10 ft. in diameter by 30 ft. long, driven trunnion type, built by the Carthage Machine Company, discharges barked logs on to a sorting conveyor equipped with six lines of Hercules No. C-132 chain and running at right angles to the barking drum, from which incompletely barked logs may



INSTALLATIONS IN MILL OF FLORIDA PULP AND PAPER CO. PENSACOLA, FLA.

7. Screen Room — IMPCO Knotter, Screen and Thickener.

8. Liquor Storage Tanks and Heat Recovery System for Digester Blows.

9. Causticizing Building and Liquor Storage Tanks.

10. Barking Drum, Wood Room and Digester Building at the Right, Causticizing Plant, Evaporators and Recovery Buildings at the Left.

11. Bleach Plant—Washer Floor.

12. Boiler House—Process Steam Distribution Headers and Pressure Reducing Stations.

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4. VICKERY DOCTORS, engineered to keep every paper-making roll at peak performance, assure better, faster operation and fewer breaks.

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be removed and returned to the barking drum. The accepted logs are discharged to an inclined conveyor with a single line of Hercules No. C-132 chain, and carried to the chipper in the wood room.

The bark from the drum drops into a gathering belt conveyor at the bottom of a hopper under the drum and is loaded into specially constructed trailer bark buggies by means of a portable belt conveyor and hauled away to a distant point from the mill to be burned.

The facilities for handling and barking of wood and the preparation of chips were designed to permit operating only a period of 8 to 10 hours to obtain the chips required to maintain 24 hours operation of the pulp mill.

Wood Room

This building with its equipment proportioned to prepare chips from the pulp logs at a rate of 15 to 20 cords per hour is located adjacent to the digester building. It is arranged with one 84-inch diameter disc., 12 knife, "Carthage" chipper, rotating at a speed of 450 r.p.m. and driven by a 150 hp. slipring Westinghouse motor through a V-belt drive. Pulpwood logs feed direct from end of chain conveyor through extra heavy spout into chipper and chips are discharged into a belt and bucket elevator which carries them to one Tyler "Ty-Rock" chip screen 4 feet wide and 12 feet long. The sawdust is carried away from a hopper under the screen by a spiral conveyor to a bin outside of the building from which point it is hauled away in the bark buggies with the bark. The rejected chips, slivers, etc., drop through a chute to a 36-inch Lombard chip crusher, direct connected to a 30 hp. motor from which the crushed chips are returned by a belt conveyor to the chip screen for re-screening.

The accepted chips from the screen are carried by a belt conveyor through the wall of the wood room and discharged into a vertical belt and bucket elevator along side of the digester building which carries them above the top of the digester building to feed into either of the two chip bins through a valve controlled bi-furcated spout. This outside centrifugal discharge elevator, which is 120 feet from center of bottom sprocket to center of top sprocket, operates at a speed of 312 feet per minute and has a belt 22 inches wide on which are 9-inch by 20-inch buckets spaced 21 inches apart. This elevator as well as all of the conveyors and conveying equipment in the wood room and wood yard were made and installed by the Jeffrey Manufacturing Company.

Digester Building

The two chip bins are each rectangular in section, 25 feet wide by 19 feet long by 42 feet high with hopper bottoms, equipped with "Jeffrey" duplex clamshell type gates, counterweighted for quick and easy operation as well as individual funnels for rapid filling of digesters. There are two welded digesters, each of 2200 cu. ft. capacity manufactured by the Babcock & Wilcox Company. Two measuring tanks each 10 ft. in diameter by 12 ft. high, are located on the digester charging and operating floor for black and white cooking liquors. Cooking is direct with saturated steam at from 110 pounds to 140 pounds pressure. Pressure temperature and steam flow control for the cooking are provided for by Foxboro flow meter and recorder equipment on the digester operating floor. Cooked pulp from each of the digesters is blown through 8-inch worm and gear operated Fairbanks blow valves through a common blow line, into a cyclone tank over the roof of the diffuser building. This tank is 13 ft. in diameter and 22 ft. high. Vapor from this cyclone rises into a cyclone type catch tank of about 7 ft. diameter and 15 ft. high. From the catch tank, steam is vented to the condenser-heater of a Foster-Wheeler heat recovery system consisting further of a 14 ft. in diameter by 50 feet high accumulator tank, a heat-exchanger, two water circulating pumps and temperature controlled regulating equipment, by means of which advantage is taken of the heat content of the digester blow steam to heat the wash water requirements of the diffusers.

Diffuser Building

From the overhead cyclone tank pulp feeds by gravity through a swivel pipe to one of a battery of six diffusers which are arranged in a circle, each with a volume of 2500 cu. ft. The diffusers have concrete bottoms under an inclined strainer bottom and each one is equipped with four wash-out nozzles through the side near the bottom. Washed pulp is removed from the diffusers by sluicing with high pressure water hose through 30-inch by 36-inch side doors at the bottom, to a 25 feet in diameter by 18 feet high circular tile stock chest, below the diffusers. The chest is provided with a vertical type agitator with three propeller type arms, driven through gear reducer and direct connected motor.

Washing and draining of the diffusers is controlled from a circular mezzanine gallery level below the diffusers from which lever operated valve assemblies of "Nordstrum" lubricated plug valves at each diffuser from the six circular headers around the outside of the diffuser stock chest make it possible for concentrated operations of testing, washing, draining, etc.

The several pumps required for the various waters and liquors are arranged on the ground floor located as near as convenient to the storage tanks from which they draw their supply. The liquor and water storage tanks required for the diffuser installation are located outside of the building and adjacent to the east and north sides of it. This group of tanks consist of the following:

1—24 ft. dia. by 30 ft. high for strong black liquor.
1—20 ft. dia. by 18 ft. high for wash liquor.
1—14 ft. dia. by 50 ft. high, accumulator for heat recovery.
1—20 ft. dia. by 18 ft. high for hot water.
1—20 ft. dia. by 18 ft. high for cold water.

This last listed tank, located outside the north side of the building is supplied with the white water returned from the pulp mill and paper mill surplus points for use in washing and dumping diffusers.

All of these tanks, as well as the cyclone tanks on top of this building and the six diffusers were made and furnished by the Chicago Bridge and Iron Company.

Screen Room

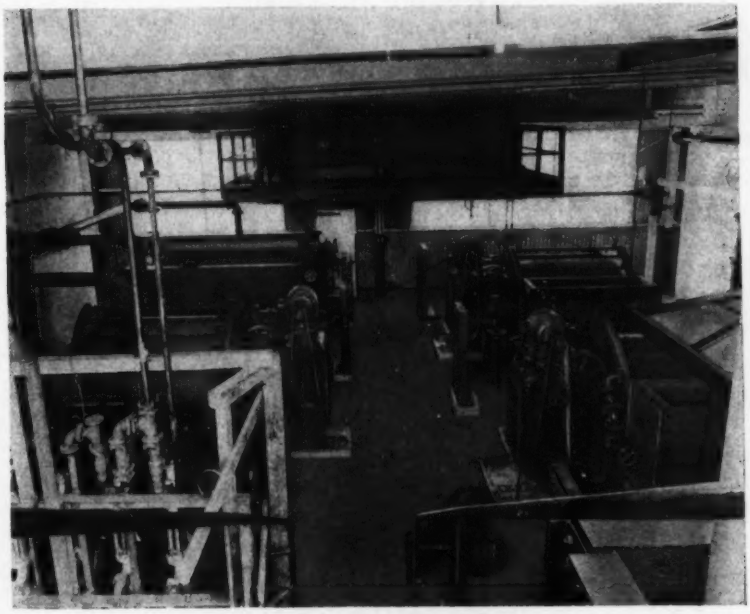
From the diffuser chest stock is pumped to a regulating box on an upper platform level in the screen room from which a gravity flow is permitted through one rotary knotter, to one centrifugal screen to one 5 ft. dia. by 5 ft. long vacuum washer-thickener, equipped with a repulper from which stock is dis-

AGAIN

THE

PAPER COMPANY

IN THE BLEACHERY



ALL OF THE WASHERS, THICKENERS, MIXERS and
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charged into a tile chest below the floor serving as a storage of brown stock ahead of either the bleach plant or for by-passing directly to the stock preparation equipment in the paper mill. The chest, 36 ft. long by 16 ft. wide by 19 ft. high, is rectangular in shape with rounded ends and a tile mid-feather wall, and is equipped at one end with a single horizontal propeller agitator direct connected to a Westinghouse gearmotor drive.

The tailings from the rotary screen are delivered by gravity to a 14 plate flat screen, bronze vat with full length scraper attachment located under the knotter platform and the accepted stock from the screen pumped to the thickener. The final rejects from this flat screen, as well as the knots from the knotter are collected in a dewatering bin and disposed of to waste with the balance of the wood refuse.

A concrete tank on the ground floor provides for seal of the vacuum leg of the thickener and collection of white water for reuse in dilution and shower requirements of the screening and thickening equipment. All surplus white water from this tank is pumped to the white water storage tank at the diffuser room for washing pulp.

The knotter, rotary and flat screens, and thickener were all manufactured and furnished by the Improved Paper Machinery Corporation. ("Impco")

Bleach Plant

The bleaching plant and bleach liquor making facilities are located in a building between the screen room and the paper machine building and when completed will provide for a four-stage continuous low density Thorne bleaching system with SO_2 treatment provided after the last stage. Brown stock is pumped from the thickener chest in the screen room to a Dezurick consistency regulator and meter control box at the head of the bleach plant from which the stock drops directly into a chlorine mixer in the basement and then circulated through the chlorination tower. The capacities and grades of bleached product expected from this bleaching installation are to be obtained from the following principal items of equipment.

1—Chlorination Tower—13 ft. dia. by 36 ft. high.
1—Caustic Tower—12 ft. dia. by 36 ft. high.
1—1st Hypo Tower—12 ft. dia. by 36 ft. high.
3—2nd Hypo Towers—12 ft. dia. by 36 ft. high.
1—SO_2 Tower—7 ft. dia. by 36 ft. high.
1—5 ft. by 6 ft. acid washer—rubber covered.
3—5 ft. by 6 ft. washers—vacuum type.
1—36 in. by 110 in. Thickener—Open cylinder type.

The seven towers are made of reinforced concrete and lined with glazed tile by the Stebbins Engineering and Manufacturing Company. Vertical agitators of special design driven by a Foote Bros. worm gear reducer through V-belt drive and Westinghouse motor have been installed in each of the seven towers.

The towers are arranged in parallel rows four on one side and three on the other spaced apart sufficiently to provide building space between them. All of the washers, thickener and metering and control equipment are located on the upper operating floor about 22 feet above the ground, and the location of all seal tanks, mixers, circulating and booster pumps are arranged on the ground floor. All of the washers, thickener, mixers, and mechanical equipment for this bleaching system were made and furnished by the Improved Paper Machinery Corporation. The addition of all chemicals to the stock is controlled from a single central control board and on the washer floor on which is mounted the various rotometers, pressure and temperature gauges and regulators, liquid level gauges, etc. All washers driven by Reeves variable speed units and V-belt drives, are equipped with repulpers and discharge direct to the inlet of the mixers on the ground floor. Pumps in the bleach plant were furnished by the Warren Steam Pump Company.

A transite hood over the acid washer, transite vent stacks through the roof over each of the other washers and a heating and ventilating unit at one end of the building above the washer floor was furnished by the J. O. Ross Engineering Company for moisture absorption and ventilating this operating room.

A laboratory is being provided in a space on the washer floor back of the control and regulating board for testing and control of the operations of the entire bleaching plant.

A storage chest 18 feet diameter by 19 feet high made of glazed tile, and with a vertical type agitator having, two propeller type arms driven by gear reducer unit direct coupled to a motor, is located just outside the east wall of the bleach building and provides for the discharge of finally washed bleach stock from the open cylinder washer. From this chest bleached stock may be delivered to the stock preparation equipment in the paper machine room.

Adjacent to the west side of the bleach building and along the railroad tracks for service is located the bleach liquor preparing building. This building houses two bleach liquor making tanks and two bleach liquor storage tanks, each rectangular and of concrete construction, also milk of lime, bleach liquor and caustic circulating pumps. Milk of lime is prepared in the causticizing plant and pumped to a milk of lime storage tank outside of this building. Caustic storage and dilution tanks and an SO_2 storage tank are located outside of, but closely adjacent to the building and convenient for unloading supply cars. Two parallel stub track sidings from the service track provide for the spotting of chlorine cars.

The bleaching plant is practically completed, except for some lines of rubber-lined piping and piping of special materials for chemical handling the receipt of which has been more or less delayed because of manufacturing conditions.

The plant is producing natural brown sulphate papers by pumping the stock from the thickener chest in the screen room direct to the stock preparation equipment in the paper machine building, by-passing entirely the bleach plant for the present.

Paper Machine Building

This building, 60 feet wide and 454 feet long, is of uniform cross section throughout its entire length, and provides at the southerly end for stock preparation. Two tile mixing tanks, 12 feet in diameter by 15 ft. high on the upper floor, each equipped with Shartle vertical type agitators, propeller type arms, and driven through gear reducer units, direct connected to motors, have been built to prepare the various grades of stock for the paper machine. Two stock lines, one for brown stock and one for bleached stock lead into the building and can fill either of these mixing tanks. These tanks are in lieu of any beaters and provide for the blending of stocks, additions of size, color, or any stock treatment. They can be operated either continuously or as a batch system and

each can discharge its charge through a dump valve to its receiving stock chest, 18 ft. in diameter by 13 feet high, constructed of tile and equipped with agitators like the mixing tanks, and located directly below the floor.

From these receiving stock chests, the stock is pumped to a battery of four Shartle No. 5 Jordans, each direct connected to Westinghouse 350 hp. Synchronous motors, 400 r.p.m. on the machine room floor level. A tile chest 18 ft. in diameter by 13 ft. high, also equipped with an agitator like the mixing tanks is located below the floor under the Jordans to receive the Jordaned stock and serve as a machine chest. The tile chests in this building, as well as those in the bleach plant, screen room and diffuser building were all built by the Stebbins Engineering and Manufacturing Company. The agitating equipment was furnished by the Shartle Brothers Machine Company.

The piping for the Jordans is arranged so that they may be operated either in series or in multiple before or after the machine chest. A continuous sample is taken from the line to the first Jordan to pass through a Trimbey consistency regulator which controls the consistency of the stock to the Jordans by the addition of fresh water at the pump suction. Stock from the machine chest is pumped through one or more finishing Jordans to a regulating box on the paper machine. The pump for mixing white water and stock supplying the paper machine has a capacity of 6000 gallons per minute.

The paper machine was designed and built by the Black-Clawson Company. It is a Fourdrinier machine 158 inches wide trimming 144 inches, capable of running at a maximum speed of 1100 feet of paper per minute and with a speed range of 5 to 1. The principal features of this machine are as follows:

Flow Box—Cypress, with flow evener roll, and quick acting dump valves.

Slice—Arranged for a head of 72 inches, adjustable type with flow evener roll.

Fourdrinier Part, Removable type, arranged for quick wire change, adjustable above and below level, wire 158 inches by 90 feet. Suction couch, cantilever type; rubber covered table rolls; eight suction boxes; dandy roll; stainless steel covered side frames and save all pans; Bertram high speed shake.

Press Part—Two suction presses, frames, footboards; rubber covered top press rolls; felt rolls; doctors; the two presses and the smoothing press are each equipped with Mason Neilan "Extract-a-load" pressure loading controls, broke conveyors, felt guides and take-ups.

Drier Part—consists of two sections of dryers, the first section with 16 dryers and the second with 15 dryers. Dryers 60 inch diameter by 154 inch face, four felt dryers 60 inch diameter and one 36 inch diameter lead dryer; all equipped with ring oiling bearings and Shartle Miami steam joints, automatic rope carrier, totally enclosed drive gearing in oil tight gear case, small diameter type of gears.

Smoothing Press—One pair rolls located between dryer sections, anti friction bearings.

Calender—One 8 roll stack, Lodding doctors.

Reel—One Pope type reel, 42 inch diameter by 152 inch face drum capable of reeling 60 inch diameter paper rolls.

Winder—"Cameron" type 18 with unwinding stand and a hydraulic controlled unloading table.

A Westinghouse sectional electric drive provided

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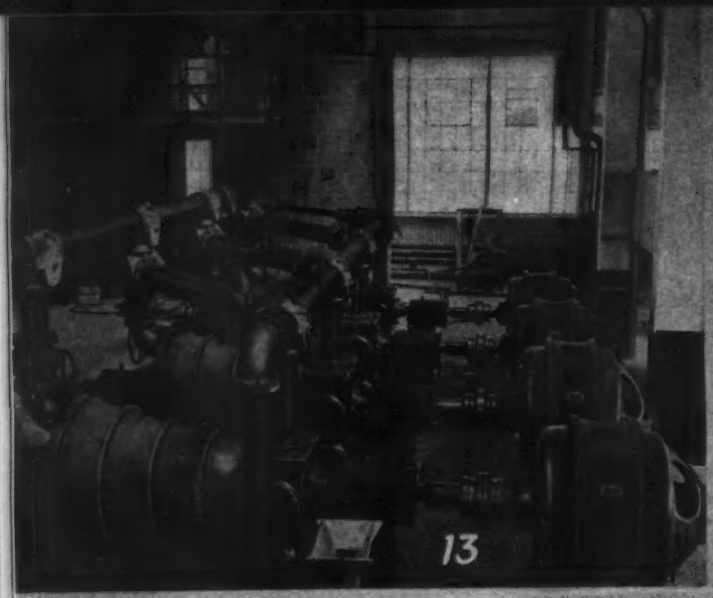
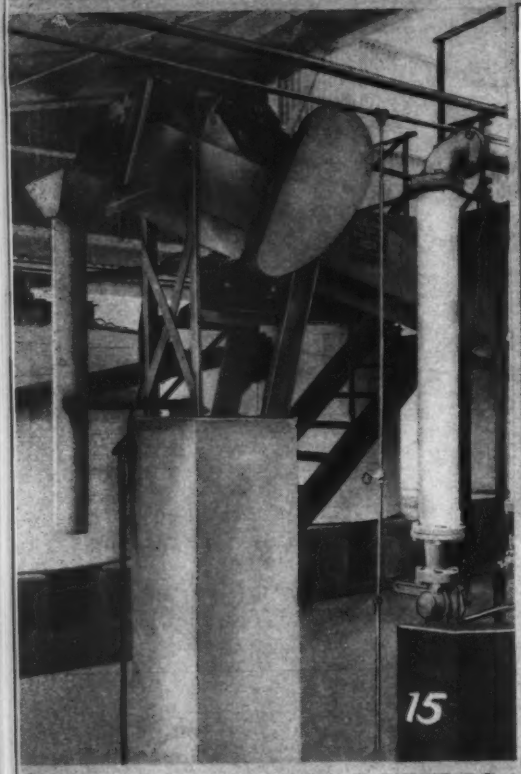




INSTALLATIONS IN MILL OF FLORIDA PULP AND PAPER CO.

PENSACOLA, FLA.

13. Paper Mill—Stock Preparation Battery of SHARTLE No. 5 Jordans Mixing Chests in Background.

14. Digester Building — Charging and Operating Floor.

15. Causticizing Plant — DORR Slaker — Classifier and Reaction Tanks.

16. Paper Machine—Drive Side—WESTINGHOUSE Sectional Electric Drive Units.

17. Paper Mill—Stock Preparation —Mixing Chests.

18. Looking Down the Machine Room from the Wet End.

for driving the paper machine, with the control switchboard, the motor driven generator set and auxiliary control sets are located on the ground floor under the drive side of the machine. There are nine individual sectional drive motor and gear drive units.

The various vacuum pumps required are driven by V-belt drives, and are as follows:

Couch	—two—Nash L 9
Presses	—two—Nash L 8
Suction Boxes	—one—Nash L 7
Felt Boxes	—one—Nash L 6

All drier gears are lubricated along with the dryer and calender bearings by a forced feed oiling system with storage tank, filters, separators, pumps, etc., by DeLaval.

The paper machine is equipped with a sectional panel transite covered hood. Four exhaust fans, with discharge stacks from them, are located outside of the wall of the machine room and on the roof of that part of the building over the drive aisle for the sectional drive motor units and exhaust the vapors from the hood through the side of the building. This equipment was designed and furnished by the J. O. Ross Engineering Corporation.

A Foxboro temperature control equipment and a Coe Manufacturing Company dryer drainage system provide for regulating the drying of paper and removal of condensate from the dryers.

A broke beater located under the winder provides for all broke from dryers, calender, reel and winder as well as that which can be brought to it from the Finishing Room.

On the lower floor of the paper machine room space is utilized for the location of calender blower, blower for ventilating motors on sectional electric drive, belt driven air compressor, oil storage tanks and pumps required for lubricating system of the paper machine.

The machine room is served throughout its entire length by a 15 ton Whiting overhead electric travelling crane with two trolley hoists.

At the north end of the machine room there is sufficient space for finishing paper and here are located a Toledo 6 ton, 8 ft. by 6 ft. scale, an Otis platform Elevator (6 ton), Moore & White sheet cutter with 8 roll back stand and Erie Layboy, a small Cameron rewinder and Seybold Trimmer. Beneath this floor area and on the level with the car floor is provided storage and shipping space for finished papers. A concrete shipping platform covered by a canopy and extending beyond the end of the building provides for loading several cars at a time for shipment.

Causticizing Plant

For the preparation of cooking liquor a Dorr continuous causticizing system has been installed and the plant is located at the southerly end of the group of buildings on the westerly side of the railroad service tracks through the plant site and far enough to the west to permit the location of the various storage tanks required between the buildings and the tracks. The equipment involved in this plant includes the following

1—Elevator for lime from storage to bin.
1—Lime Bin and Feeder—12 ft. diameter by 6 ft. with conical bottom.
1—Combined slacker and classifier.
3—Causticizing or reaction tanks 7 ft. 6 inches diameter by 6 ft. high
1—Milk of lime tank 4 ft. diameter by 4 ft. high.
6—Liquor pumps—Worthington.
1—Green Liquor heater—spiral.
1—Combined thickener and washer 28 ft. diameter by 29 ft. high—five compartments—for white mud.
1—Waste Sludge Tank 9 ft. diameter by 9 ft. high.

These last two items of equipment are located outside of the causticizing building along with the following storage tanks for liquors:

Raw Green Liquor—1 tank 20 ft. diameter by 18 ft. high
Weak Wash Liquor—1 tank 20 ft. diameter by 18 ft. high.
Strong White Liquor—2 tanks 20 ft. diameter by 18 ft. high.

A Foxboro installation of flow control and temperature regulation for liquor, water and steam with accompanying recording and regulating equipment has been provided in this installation.

There is located also in this building a 4 ft. in diameter by 4 ft. high tank for slaking lime and preparting milk of lime for the bleach liquor making plans. This tank is equipped with a vertical Turbo-Mixer agitator and fed by a Jeffrey vibrating feeder from the lime bin.

Raw Material Storage

Adjacent to the north side of the strong white liquor storage tanks and between the causticizing building and the service tracks there is located a building 20 ft. by 64 ft. for the storage of raw lime and north of this building and adjacent to it is a building of similar construction 40 ft. by 64 ft. for the storage of salt cake. An unloading platform of concrete covered with a canopy along the track side of these two buildings provides for the convenient unloading of lime and salt cake cars. A Jeffrey pulverizer located at the Northwest corner of the storage building and a bucket elevator provides for reclaiming the salt cake for delivery to the recovery room.

Evaporator Room

In this building 20 ft. wide, located adjacent to the north side of the salt cake storage building, is installed a four body, quadruple effect, long tube vertical, black liquor evaporator unit, designed and built by the Swanson Evaporator Company with all the necessary pumps, by LaBour and auxiliaries for the concentration of the black liquor obtained from the pulp production.

The evaporators operate at 45 pound steam pressure which is controlled by a Foxboro Steam Pressure controller and valve.

A tank 24 ft. by 30 ft. high, located north of the evaporator building provides storage for the heavy black liquor from the evaporators for delivery to the recovery unit.

Recovery Room

In this building located north of the evaporator room, is a Tomlinson Recovery unit, rated 75 ton capacity, furnished by the Babcock and Wilcox Company and is equipped with a water tube furnace, boiler, economizer, air heater and a separately fired superheater, fired by natural gas. The boiler operates at 400 pounds steam pressure. The forced draft fan, steam turbine driven and the induced draft fan motor driven were furnished by the B. F.

Sturtevant Co. A complete liquor, steam and combustion control and metering equipment made by the Bailey Meter Company have also been provided.

Under the operating floor, which is about 21 feet above the ground, and on which are located the black liquor mixing tanks, salt cake hopper and feeder, Worthington liquor feed pumps and control panel is a 12 ft. diameter by 8 ft. high dissolving tank. Agitation in this tank is obtained by means of a circulating pump and the delivery of green liquor to the causticizing plant is controlled by a Mercoid switch control on the operation of a Warren liquor pump.

From the 24 ft. by 30 ft. storage tank liquor is pumped to a Babcock and Wilcox spray tower, where further concentration is obtained. From the vat of the spray tower the liquor is pumped to a storage head tank at the top of the Recovery building feeding through Bailey regulating and metering equipment into the mixing tank, where salt cake is added by means of a Jeffrey vibrating feeder. The salt cake is delivered to a hopper bin over the mixing tank by means of a Jeffrey spiral conveyor running across the top of the Evaporator building roof from the discharge of the elevator in the salt cake storage building.

Carefully planned locations of steel walkways with Tri-lok grating surfaces and stairways permit convenient convenient access to all parts of the recovery unit for operation, dust lancing, etc.

The separately fired superheater is located back of the recovery unit, on the ground floor, and facing the firing aisle of the boiler plant. It is fired with one B & W gas burner with drafts and fuel supply regulated by a Bailey temperature control equipment. Forced and induced draft fans, motor driven, furnished by F. B. Sturtevant Co. and a Leeds and Northrup temperature recorder with thermo-couples on the superheater tubes complete the equipment for this superheater unit.

Boiler House

One Babcock and Wilcox, integral fired furnace boiler, gas fired, with a normal capacity of 80,000 pounds steam per hour and capable of peaks of 90,000 pounds steam per hour has been installed in the boiler house. It operates at a 400 pound pressure and is equipped with a superheater, an air heater, steam turbine driven forced draft fan and motor driven induced draft fan. A Bailey combustion control and metering equipment provided on a panel at the front of the boiler on the firing aisle permits a controlled operation of the five B & W natural gas burners and draft controls. Feed water regulators for both this boiler and the one on the recovery unit were furnished by the Bailey-Meter Company. The two draft fans are located on a platform over the top of the boiler, between the boiler setting and the feed water heater and pump rooms.

There are three boiler feed pumps, two of them motor driven and one steam driven by a Westinghouse mechanical turbine, located on the ground floor level of a pump and heater room adjacent to the east side of the boiler room. A 1500 GPM centrifugal fire pump, by Warren Steam Pump Company, steam driven by a Westinghouse mechanical turbine is also in the same room in line with the boiler feed pumps.

An Elliott deaerating feed water heater, 125,000 pounds per hour capacity operating on 3 pound pressure from exhaust steam from mechanical turbines is located on a floor over the top of the feed pumps. Above this floor on the roof of the building is located a 12 ft. high steel tank for the collection of all return condensates and hot waters serving as flash tank and makeup tank ahead of the feedwater heater.

A Permutit water softening installation of Zeo-Carb units and a CO_2 degasifier tower is located along side of the feed water pump room for suitable conditioning of boiler feed water supply.

All of the steam generated 400 pound pressure 650° F. temperature flows normally to the throttle of the turbine in the power plant. From the turbines, steam is extracted from both the 150 pound and 50 pound pressure stages to individual process headers at the north end of the feed water-heater room. At this location all of the pressure reducing stations between the different process pressure headers, bypasses around them, distributing main control valves, de-superheater, atmospheric relief provisions, etc., have been placed and arranged to provide a convenient and accessible centralized steam distribution control.

From this piping center process lines of steam extend across the railroad service tracks on a bridge to supply paper mill, bleach plant and digester room with steam while other lines are carried to the evaporator room, causticizing plant and to steam driven auxiliaries in the boiler house and recovery room.

A Worthington air compressor and receiver unit located on the feed water heater floor provides solely for the air supply required for all recording and metering equipment as well as all regulating valves and equipment.

The stack and steel plate duct work from fans were fabricated by the Southern Tank and Boiler Works of Memphis, Tenn.

The piping for the boiler house, power plant and all process piping for the pulp and paper mill including also the piping in the bleach plant was furnished and erected by the Pittsburgh Piping and Equipment Company.

Insulation and covering for all of the steam piping in the boiler and power plants and for the requirements in the paper mill, pulp mill and bleach plant as well as all tank insulation was furnished and installed by Guy F. Beatty of Charlotte, N. C.

Power Plant

In the electric generating power plant, a building 35 ft. wide by 53 ft. long, located at the north end of the group of buildings on the west side of the service tracks and adjoining the boiler house, is installed a Westinghouse 3500 kw. steam turbine driven generator 2300 volts AC with direct connected exciter, double extraction, condensing with 2500 square feet surface condenser. Condenser is provided with divided water box, air ejector and after condenser units, circulating water pump, condensate pump and condensate draining equipment. Condenser is suspended direct from turbine exhaust flange.

A Chicago Pneumatic Compressor on the power plant ground floor level provides all the air needed for lancing the recovering unit as well as for all requirements of the boiler house and power plant.

The turbine generator control and exciter panels, voltage regulator, and various 2300 volt distribution panels are arranged as one switchboard along the North side of the power plant parallel with the turbine generator.

The various 440 volt distribution panels are located in line with the 2300 volt panels and near the East end of the building. To provide for 440 volt cur-

rent supply a bank of three 8.33 kva. outdoor type transformers are in place outside of the North wall of the turbine room. The 2300 volt and 440 volt switch gear and the transformers are all of Westinghouse design and manufacture.

A 7½ ton hand crane Whiting is provided over the turbine generator unit.

Electric power feeder cables are carried in conduits, extend below the main turbine floor level and are carried on the pipe bridge over the service tracks to the paper mill, pulp mill and bleach plants.

These feeders are carried to centrally located power distribution centers throughout the building at which places an assembly of disconnect switches and de-ion starters on a structural framework provide control points for the various motors

All of the power wiring, illumination, motor control installation as well as the wiring for the sectional electric drive of the paper machine is carried in conduit throughout the mill and was provided and installed by the Allegheny Industrial Electric Company of Pittsburgh, Pa.

Water Supply

Five wells drilled on the site by the Layne-Central Company, each equipped with a Layne vertical centrifugal well pump provides the water for the mill. Each delivers 100-120 gallons of water per minute into the mill system. All of the water is delivered to a point in the electric power house where an arrangement of piping provides for the control of the distribution of water through the condenser and to the process. The water is exceptionally pure and free of anything that would affect process or bleaching.

An elevated water storage tank 100,000 gallon capacity 125 feet high for sprinkler protection, and a sprinkler installation in the paper mill and pulp mill group of buildings has been provided.

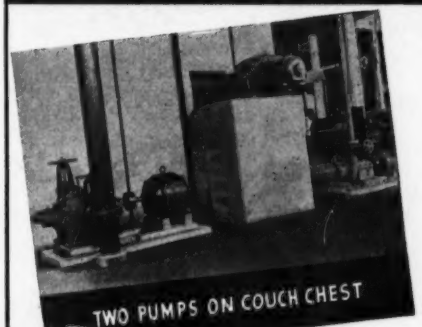
A separate water storage tank 36 ft. diameter by 22 ft. high located near the high sprinkler supply tank provides secondary storage ahead of the fire pump and deliverable water only by means of this pump.

An underground fire main loop, with hydrants suitably located extends around the mill buildings and affords acceptable fire protection.

There existed on the west side of the San Francisco Railroad right of way and on the company's property, a natural depression of ground, extending westward and grading away from the mill site, flanked on both sides by natural ridges of land. At a distance of about 1800 feet from the railroad, which crosses this valley on a wooden trestle, the bottom of the depression is at the water level of the end of an existing swamp. This swamp narrow at this point varies in width and extent in a meandering line, feeding a creek which in turn empties into Perdido Bay and ultimately the Gulf of Mexico several miles away.

The surface of this shallow valley was stripped and deepened in places obtaining sufficient earth to build an earthen dike or dam across the valley forming a collecting and settling pond about 1200 feet long, 400 ft. wide averaging about 8 ft. in depth through the center. An overflow spillway empties into a second similar pond formed by another dike or dam located about 1500 feet below the first dam.

ANOTHER SOUTHERN MILL GOES WARREN!



TWO PUMPS ON COUCH CHEST

PUMP FOR WEAK LIQUOR TO RECOVERY ROOM

PUMPING STOCK TO JORDANS

Newly opened Florida Pulp and Paper Company plant at Pensacola.

54 WARREN PUMPS for such services as:

Black Liquor
Green Liquor
Bleached Liquor
Stock—thick and thin
White Water
Wash Water—hot and cold
Showers
Caustic
Boiler Feed
Underwriter Fire

Why WARREN?

Because Warren Paper Mill Pumps not only stay with their jobs and protect against costly service interruptions but they do their jobs, year after year, at consistently low operating and maintenance costs.

For low pumping costs today and tomorrow, write Warren into your pump specifications.

WARREN STEAM PUMP COMPANY, INC.
WARREN, MASSACHUSETTS

This second pond provides also for further settling, aeration, etc., and the overflow from the spillway on this dam discharges its water into the meandering creek.

About 300 feet south from the causticizing plant there existed a gum swamp at the bottom of a natural depression in the ground. The gum was removed from this area and the waste lime sludge from the white mud washer is pumped into this area and the mud deposited out in small ponds leaving the water overflow to the main drainage ditch that carries the rest of the mill effluent to the collecting ponds.

The floor drains and process effluents are taken care of through underground tile pipe lines to a drainage ditch about four feet wide at the bottom, sloping earth sides and with drainage fall enough to carry away all of the mill effluents and a lot of the surface drainage to the collecting pond. This drainage ditch is located on the west side of the railroad service tracks, runs parallel with the building arrangement between the service tracks and the railroad rightof-way fence. It extends for the full length of the site beginning at the northerly end and following the Railroad tracks at the southerly end until it joins the drainage ditch at the head of the collecting pond.

Contractors and Vendors

Credit is due the contractors, sub-contractors and vendors of equipment for the quality of material supplied, for fair prices and terms for shipping services rendered and for all other assistance afforded by their cooperation and well directed efforts in the development of the new pulp and paper mill for the Florida Pulp and Paper Company. The list of these contractors and manufacturers of the principal equipment in the mill follows:

Rust Engineering Company	General Contractors
Layne Central Company	Wells
Improved Paper Machinery Co.	Bleachery & Screen Room Equipment
Chicago Bridge & Iron Co.	Metal tanks, Cyclone Diffusers and Water Tanks
The Babcock & Wilcox Co.	Boiler, Recovery Unit, Spray tower, Superheater and Digesters
Westinghouse Electric & Mfg. Co.	Turbine, Motors, Generators, Sectional drives, and Switch Gear
Pittsburgh Piping & Equipment Co. Guy Beatty	Piping Contract or Insulation and Pipe Covering
Allegheny Industrial Electric Co.	Electrical Wiring Contract
Stebbins Engineering & Mfg. Co.	Tile Chests and Tower Linings
Swenson Evaporator Co.	Evaporators
Warren Steam Pump Co.	Pumps
The Dorr Company	Causticizing Equipment
Shartle Brothers Machine Co.	Jordans and Agitators
The Black Clawson Co.	Paper Machine, Calender and Reel
The Nash Engineering Co.	Vacuum Pumps
United Gas Pipe Line Co.	Natural Gas Supply
Carthage Machine Co.	Chipper, Barking Drum
DeZurik Shower Co.	Consistency Regulator in Bleach Plant
Stowe Woodward, Inc.	Rubber Covered Rolls
Bailey Meter Company	Combustion Control Meters, Recorders and Feed Water Control
Mason-Neilan Regulator Co.	Press Roll, Liquid Level, Steam Pressure & Chlorine Pressure Controllers
Jeffrey Mfg. Co.	Wood Conveyors and Salt Cake Conveyor and Elevator
Cameron Machine Co.	Winder
Waterville Iron Works	Chip Crusher
The W. S. Tyler Co.	Chip Screen
Stupp Brothers Bridge & Iron Co.	Steel Framing for buildings
Mobile Steel Company	Misc. Steelwork, Walkways, Stairs
Foster-Wheeler Corp.	Digester Blow Heat Recovery Equipment
The Tri-lok Company	Floor Gratings and Treads
Morey Paper Mill Supply Co.	Dryer Felts
Williams-Gray Company	Felts and Fourdrinier Wires
St. Louis & San Francisco Railroad	Railroad Service Track
J. O. Ross Engineering Corp.	Bleach Plant and Paper Machine Ventilation Systems—Hood
Beloit Iron Works	Suction Couch and Suction Presses
Worthington Pump & Machinery Corp.	Air Compressor and Pumps
Elliott Company	Feed Water Heater
Virginia Smelting Co.	SO_2 Storage, Vaporizing and absorbtion equipment
The Permutitt Co.	Water Conditioning Equipment
B. F. Sturtevant Co.	Blowers, Fans
Whiting Corp.	Overhead Cranes
Moore Pipe & Sprinkler Co.	Fire Protection
Hercules Powder Company	Rosin size equipment
The DeLaval Separator Co.	Paper Machine Oiling System
The Foxboro Company	Meters & Control Valves
The Coe Mfg. Co.	Paper Machine Drainage System & equipment
Independent Roofing & Mfg. Co.	Roofing, Flashing and Duct Work
B. F. Fairbanks Co.	Digester Blow-Valves
Southern Tank & Boiler Works	Stacks & Flues

Install Camachine at Pensacola

The Florida Pulp and Paper Company has installed the Camachine 18 heavy duty mill type winder illustrated herewith, in connection with its paper machine. The winder is 144 inch trim width, 148 inch drum face. Rewound rolls up to 60 inch diameter can be handled on this winder at speeds over 2,000 f.p.m.

Every provision has been made in the winder for winding rolls of uniform density for the pressure of both the rewind shaft and riding roller is controlled by a system of automatic counterweights.

CAMACHINE 18

One of the modern features incorporated in the design of this winder is an hydraulic roll unloading table, which permits the unloading of a set of rewound rolls from the winder in a matter of 30 to 45 seconds.

Camachine 18 is a ruggedly built winder throughout, designed to handle rolls which at times weigh over 10,000 pounds. This winder is one of a number built by Cameron Machine Company in recent years incorporating shear cut slitter units.

Complete Stowe-Woodward Installation On New Florida Machine

The forty-five rubber covered rolls on the new Black-Clawson Fourdrinier machine at Florida Pulp and Paper Company were furnished by Stowe-Woodward, Inc., Newton Upper Falls, Mass. The installation consists of 27 table rolls, 12 plain felt rolls, 2 wormed felt rolls, 3 top press rolls and a top breaker stack roll and represents a 100% installation for this rubber roll manufacturer inasmuch as the bottom press rolls and bottom breaker stack rolls were not rubber covered.

Masonite Corp. Improves Mill At Laurel To Increase Output 20 Per Cent

The expansion program of the Masonite Corporation, Chicago, Ill. inaugurated during the past year involved expenditures of $1,400,000. Approximately $650,000 was applied to the expansion of the corporation's manufacturing plant at Laurel, Miss. Through this program the corporation will be able to meet the increasing demand for its products in national defense and for civilian use. It is estimated that the improvements in the large Masonite Laurel, Miss. mill will result in a 20% increase in the output of hardboard, semi-plastics and insulation board.

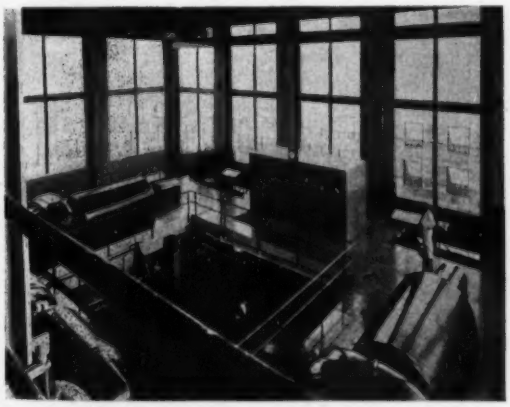
New Power Plant Cost $800,000

A new power plant in the TVA area and the eighth largest industrial generating station in the South, went into operation in August, 1941. This gas fired, steam turbine electric power plant cost $800,000.

The largest single expenditure was the purchase for $230,100 of two turbine generator sets and accessories from the General Electric Company.

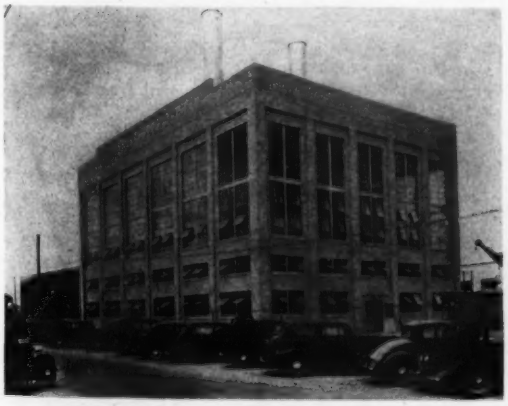
It not only provides sufficient power to take care of the Masonite plant's requirements, but releases surplus power. The new power station will thus relieve the power requirement load in the Southeast to a substantial extent. Some 10,000 kilowatts of

EXTERIOR VIEW DOUBLE CONVEYORS

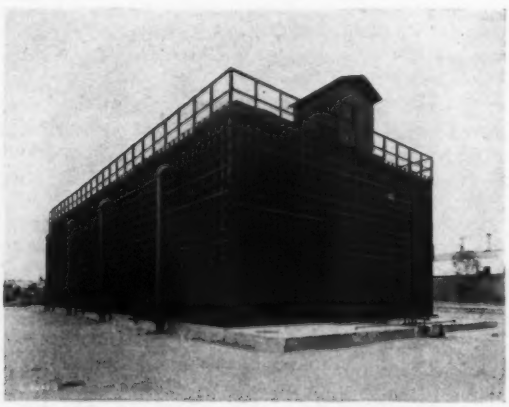


INTERIOR VIEW NEW POWER PLANT

INTERIOR VIEW MASONITE WOOD ROOM



EXTERIOR VIEW NEW POWER PLANT



EXTERIOR VIEW PRESDWOOD TOWER

electricity formerly consumed by Masonite and purchased from the Mississippi Power Company, is now made available for other defense purposes, in addition to the surplus which the new Masonite power plant will now provide. This surplus power, amounting to about 100,000 kilowatt hours per day, is sold to the Mississippi Power Company.

Long Range Policy in Timberlands

The timberland acquisition of the Masonite Corporation, says Ben Alexander, president, is designed to perpetuate on a sustained yield basis, present and future supply of wood used in manufacture. This policy has been continued during the year through the acquisition of approximately 18,000 acres of timberland bought under the long range program. Holdings now total 137,305 acres, representing an investment, less reserve, of $583,128. The Masonite Corporation has been fortunate to have no bottleneck problems or shortage of raw material. Locally grown wood is Masonite's basic raw material and virtually its only major material.

Wood Room Previously Modernized

Preceding the expansion program of this year, the wood room was enlarged and completely modernized. Two large chipping units now provide a constant flow of screened chips 24 hours daily. The log feeding conveyor system has also been enlarged and improved.

Output of Hardboard Increased

Improvements added to Unit No. 2 of the Laurel plant, include a new press. Additional equipment was added, including the humidifying units which were lengthened and enlarged. Changes made in operating procedure in Unit No. 1, where insulation board is manufactured, now make it possible for a portion of this unit to be used for the production of hardboard products.

Taylor Control Units at Ecusta

Seventeen Type 1 Taylor automatic beater roll pressure control units were installed in the plant of the Ecusta Paper Corporation, Pisgah Forest, N. C. since January 1 of this year. These control units described in the Taylor bulletin No. 98113 are used in processing pulp for the manufacture of the high class specialties made by that company.

Means of measuring and automatically controlling of beater roll pressures as embodied in this control unit, is a Taylor Instrument Companies' development, and makes possible the adjusting automatically of beater roll pressures to any predetermined schedule of pressure and time.

It has eliminated to a very large extent the human element in controlling the most important mechanical variables present in a beating engine. It makes possible the exact duplication of previous satisfactory results.

The Taylor beater roll pressure control system is a further development of the beater roll pressure recorder that has been in successful operation in many fine paper mills in this country and Canada for several years. The load measuring element is specially designed and can be installed on every make and type of beater. Its use makes possible a higher beater efficiency, and the processing of stock in the minimum of time for each furnish and at the lowest power consumption per ton.

Sorg Continues Modernization Program

Last year The Sorg Paper Company installed two cyclifiners to take the place of the ten beaters that were used for the treatment of stock for its No. 6 Machine at its plant at Middletown, Ohio. In order to insure proper treatment of stock for all types of papers and to increase production of certain grades, it now has on order another cyclifiner for this machine. The operation of this additional refiner necessitates the installation of a completely new power line from its central power station and new transformers, switches, etc. It is expected that this equipment will be delivered within a few weeks, when it will be put into immediate operation.

The operation of this cyclifining system has proved so entirely satisfactory that similar equipment is now on order and partially installed for the company's No. 1 Machine. This idea refining system, which insures absolutely uniform treatment of all fibers, has resulted in a definite improvement in all grades of papers manufactured and in considerable reductions in power, labor and maintenance costs. In order to adequately house this new equipment, one of the company's three beater rooms is being completely rebuilt without any interruption of operations on any of the three machines that are operated in connection with it. It is expected that the building program and installation of the refining equipment, including a large hydrapulper for breaking up the stock, three enormous tile-lined chests, and the necessary pumps, valves, etc., will be completed within a few months.

The company has continued its extensive improvement program which has included additional chloramine equipment to insure cleaner papers, a wrapping machine for automatically packaging paper ranging in size from 8 x 10 inches to 8½ x 14 inches, humidity control equipment for their finishing room, an automatic paper sorting machine, an additional deep well assuring the company of an adequate supply of ideal water for paper manufacturing purposes, an automatic moisture control apparatus on paper machines, Ross machine hoods, and numerous other minor improvements. In addition to the foregoing, orders for four large "Impco" vacuum type save-alls of the most modern and efficient design have recently been placed and delivery is expected on this equipment within a few months.

The company is also in the midst of a very extensive enlargement and improvement program at its recently acquired pulp mill at Port Mellon, British Columbia. These changes will result in definite improvements in the quality of pulp manufactured at this mill, as well as an increase in the production within the next few months from approximately two thousand tons to over three thousand tons a month.

September Index Higher

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., November 26, 1941—September index of the value of paper mill inventories was 117.6 compared with 114.6 in August and 108.4 in September of last year taking December 31, 1938 at 100 according to the monthly business survey of the Department of Commerce.

Taking January 1939 at 100 the September index of the value of paper manufacturers shipments was 190 compared with 181 in August and 137 in September of last year.

Modern Paper Mill Drives

By E. R. Rath, Vice-Pres., Power Transmission Council, Inc.

While the proper and economical design of drive equipment is of great importance in all industries, it is of the utmost importance in papermaking. The large quantities of power used in papermaking, its relative high percentage of the total cost of the finished product, the absolute necessity of keeping the rolls in the paper machines all turning at the correct relative speeds, and the importance of continuous operation all require in paper making more than in almost any other industry the choice of the right drive for each job. The manufacturers of transmission equipment realize the drive problems of the papermaking industry and have spent considerable time and money in the development of suitable drive equipment.

The basic principles underlying the development and application of mechanical drive equipment for papermaking machinery have been:

1—minimum initial investment;
2—low operating cost;
3—simplicity and ease of operation;
4—low maintenance costs;
5—reliability and assurance of continuous production.

All of these advantages of mechanical power transmission equipment result in a reduction in the cost per ton of paper produced.

In a modern paper mill a great deal of power is required, and while this power may be generated from steam engines or turbines, internal combustion engines, water wheels or hydraulic turbines, it is usually transmitted mechanically. The average paper machine, for instance, is driven from a main line shaft, operating at constant speed, usually located in the basement and extending the full length of the machine. The various sections of the machine which may run at different speeds are driven from the main line shaft each by a pair of tapered cone pulleys which permit changing the speed or "draw" of the sections as required. Sectional line shafts on the machine floor drive the various rolls through right angle gear drives. Heavy line shafts and jack shafts are also much used for driving other paper mill equipment including beaters, jordans, pumps, agitators, winders and screens. Some machines are driven from individual motors requiring pivoted motor bases, belt governors, etc. All these involve the use of shafting, hangers, bearings, pulleys, belting, belt shifters, clutches, collars, and in fact practically every item that has been developed for the transmission of mechanical power.

Anti-Friction Bearings

The development of modern anti-friction bearings was a very important step in the modernization of paper mill drives. Through their use the friction load is reduced to a minimum, and problems of lubrication are practically eliminated. Their application has resulted in increased efficiency and a reduced cost of power, which in turn means a reduction in the cost per ton of paper produced.

Flat Belting

Flat belting manufacturers realized the important part that their product played in the production of paper and likewise made improvements. Today high-grade belting is available and is being used to drive the largest and fastest paper mill machines. In the application of this high-grade belting the required constant and uniform machine speeds can be maintained, maintenance is reduced to a minimum, and shut-downs due to belt failures, where the correct belt has been properly applied, are almost unknown.

One important advantage of flat belt drives that is sometimes overlooked by some operators is the advance warning it gives of failures that may be expected. Every piece of electrical or mechanical equipment, irrespective of its composition, maintenance or function, must at some time fail. An unforeseen failure and one for which proper preparations have not been made, especially in the papermaking industry, can be disastrous. Modern flat belting, when properly made and installed, does not as a rule fail instantaneously but usually shows some indication of trouble, such as squealing, etc., long before that trouble becomes too serious. This advance warning enables the operator to either correct the fault which is causing the failure, or to secure the proper and necessary replacement materials.

Probably one of the greatest advancements made in the application of flat belt drives in recent years is the development of the pivoted motor base. Through the application of pivoted motor bases belt tension is automatically maintained at the correct value at all times, resulting in maximum belt capacity and efficiency. Furthermore, with their use belt tensions and bearing pressures never need be excessive, so that the life of both belts and bearings is increased. All belts, irrespective of their shape and the material from which they are made, will, due to load and initial and centrifugal tensions, gradually elongate. This elongation, when the belt is operating on pulleys at fixed centers, reduces the effective tension in the belt and may cause excessive slippage, which in turn reduces the effectiveness of the drive and the life of the belt. The pivoted motor base automatically compensates for this elongation and insures correct belt tension at all times, irrespective of the load being carried.

Another great advantage of the pivoted motor base is the reduction of required pulley center distances, whereby considerable saving in space can be made. The pivoted motor base provides through external means on a short center drive the required belt tension which is furnished by belt sag in long center drives.

Installations in several hundred mills prove that pivoted motor bases meet the drive requirements of beaters, jordans, stock pumps, chippers, vacuum pumps, slitters, banking drums, etc.

Chain Drives

Chain drives, while probably not so common in the papermaking industry as are belt drives, nevertheless fit certain conditions and have a definite place in the mechanical power transmission system. Great strides have been made during the past few years both in design and metallurgy, with the result that chain drives

have been steadily improved. Their application in many cases is the proper solution to drive problems, particularly those involving slow speeds, or where a fixed speed ratio must be maintained, or where temperatures are excessive, or where space is at a premium. Chain drives are low in first cost, are comparatively easily installed and maintained, and are quite efficient in operation.

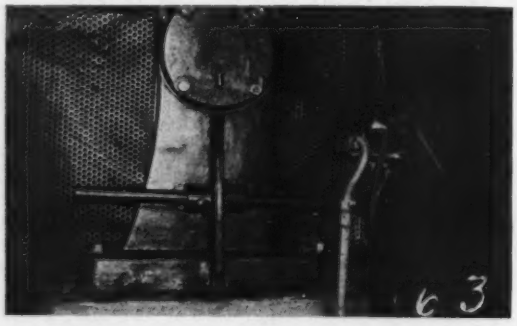
Rope Drives

Rope drives, while one of the oldest forms of mechanical power transmission, still find many supporters among paper mill operators and engineers. When properly designed and installed, even though they may not be considered the most modern by some, rope drives can and do produce satisfactory and efficient results. Some rope drives installed in paper mills over fifty years ago are still giving good service. Additions to and modifications of present rope drives, where there is need of increased production, may save many thousands of dollars over the cost of new or different types of drives.

V-Belt Drives

Another drive that has become quite popular in recent years for certain applications in paper making is the multiple V-belt. This type of belt has certain advantages in that it is comparatively easy to install, can be used on short centers, is quiet in operation, and the elastic nature of the belts and the wedging action between them and the sheave grooves allows the drive to absorb some of the fluctuations in power or shock loads met with in the average drive. They, as do all other forms of belting, have certain disadvantages.

While V-belts are generally easy to install, complications can arise, as with any endless belt, if it is necessary to dismantle part of the equipment in order to get them on the pulleys. They require more careful alignment than flat belt drives, and every precaution must be taken in the ordinary drive to keep the shafts parallel and the grooves of the sheaves in line. Failure to do this results in rapid wear of the side walls of the belts. Recent observations and tests show, furthermore, that the overload capacity of a V-belt is seriously and critically affected by belt tensions. Since it is extremely difficult to measure belt tensions in the field, one of the best ways to adjust the drive for proper tension is to tighten up on the motor base until slip ceases. This can be observed by simultaneous speed readings taken on both driver and driven pulleys while the drive is operating under peak load conditions.



Electric Belt Shifter Providing Push Button Sectional Speed Control of Paper Machine

Belt Driven Machine Making Kraft 220 Inches Wide at 1250 F.P.M.

Some people believe that since a V-belt does not squeal and since it does not run off its sheaves, it does not slip. Recent tests show, however, that slippage as high as 15 to 20% can occur without any external indications. When serious slip does occur, however, it can be detected by the heating of the sheaves, which may be so great, in fact, as to heat by conduction the motor bearings. Furthermore, it is well to keep in mind that the normal life of the V-belts may be materially shortened by operating them under conditions of either too high tension which causes the cord sections to fail due to fatigue, or too low tension which causes the belts to slip excessively, thus leading to serious overheating (possibly even burning) and deterioration.

Clutches

Clutches, which are used in so many different ways in the drives for papermaking equipment, have kept pace with the development of drive elements and are available in many types, sizes and designs. As in the case of other drive elements, there is no one clutch universally applicable to every condition, and the selection of the right one for any particular installation requires careful consideration of the drive requirements. The speed of the shaft upon which the clutch is to be located, the frequency of engagements, the atmospheric conditions, the power capacity requirements, the starting torque, the safety hazards, all must be considered in the selection of a clutch. Due to the diversity and multiplicity of clutch design, construction and application, the recommendations of a reliable clutch manufacturer are the best assurance of the most economical selection for a given job.

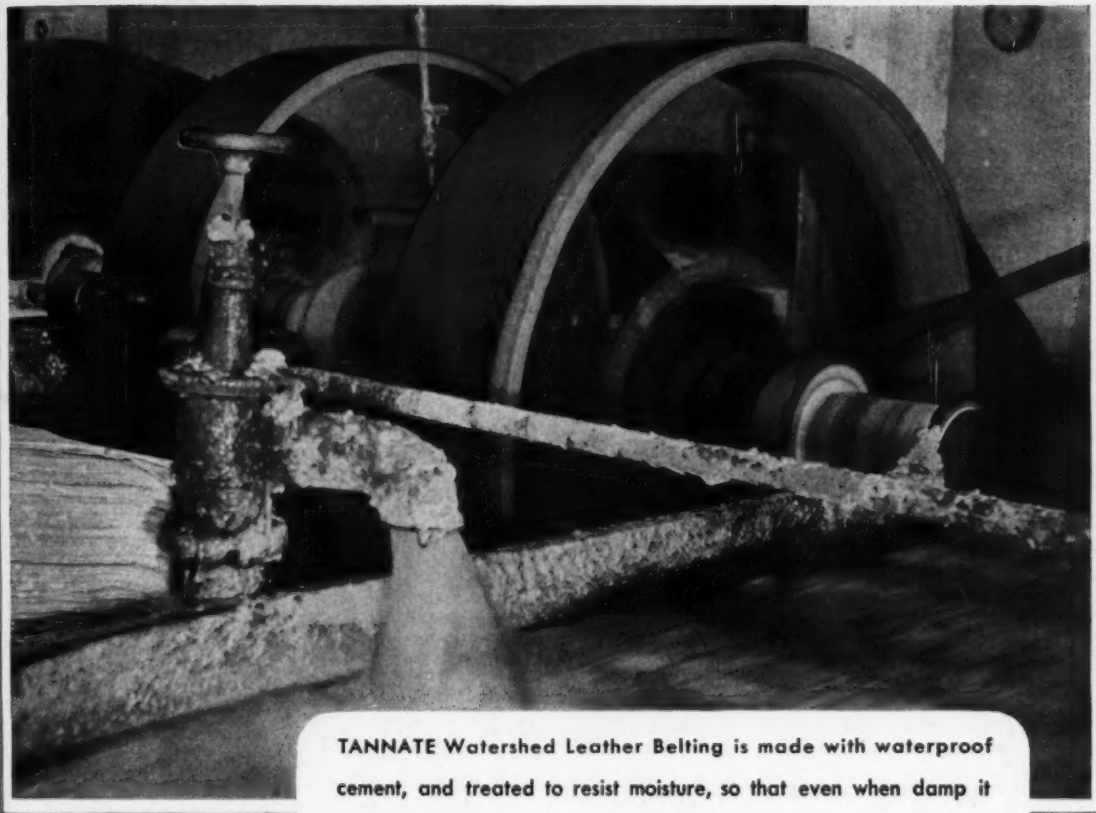
Beater Drives

The beater might be considered as the heart of the papermaking industry. Its power requirements are quite severe and new machines now generally come equipped with anti-friction bearings. While most of the power supplied the beater is used in mixing the stock, substantial savings in power have been reported where anti-friction bearings have been substituted for plain bearings on the old beaters.

Beater drives are troublesome, not only because of the heavy overloads that are frequently encountered, but also because of the speeds at which they must be operated. In the case of the individually motor driven beaters, in order to get the proper reduction from the motor to the beater it is necessary to use a motor pulley of such small diameter as to limit the belt thickness and consequently the horsepower transmitting capacity of the belting. This can be overcome by the employment of a speed reducer in conjunction with

TANNATE WATERSHED LEATHER BELTING

Does what its name implies



20" double Tannate belts on beaver drives in the midwestern paper mill shown here have been giving excellent service since the first one was installed over 6 years ago.

TANNATE Watershed Leather Belting is made with waterproof cement, and treated to resist moisture, so that even when damp it will carry nearly full load without the possibility of laps or plies separating. This is very important in paper mill service—but what is much more important is that its other properties will enable you to get greater production and lower unit output cost. Write for details.

STEP UP PRODUCTION with

RHOADS

Established 1702

Tannate WATERSHED LEATHER BELTING

J. E. RHOADS & SONS
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•
NEW YORK
•
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•
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a high speed motor. This combination permits the use of a proper sized drive pulley, and which in some cases does not cost any more than a slow speed motor with its pulley, and results in a more favorable drive and consequently more satisfactory performance of the beater.

In certain beater drives where floor space is at a premium, or where clear passageways are required, belt tighteners or belt governors can be used. While these belt governors are highly effective, it is important to realize that they should be properly selected and applied, and the belt used with them should be capable of withstanding the reverse flexing to which it is subjected. With their use:

1—a heavier load can be transmitted with the same belt width, speed, and maximum tension;
2—floor space can be saved;
3—belt slippage is reduced;
4—the life of the belts is lengthened;
5—the arc of belt contact with the pulley is increased;
6—satisfactory performance can be obtained with practically any reasonable ratio of pulley diameters.

The pivoted motor base, which is a newer development, has many of the advantages of the belt tightener and eliminates some of the possibilities of errors of judgment that may occur on the part of operators in installations. When it is used, the center distance between driver and driven pulleys changes with the belt elongation, and constant belt tension and consequently drive capacity are maintained. Pivoted motor bases, when used with a high speed motor, a geared speed reducer, large drive pulley, and a flat belt, have been proven to be reliable, economical and efficient. This combination makes an ideal beater drive.

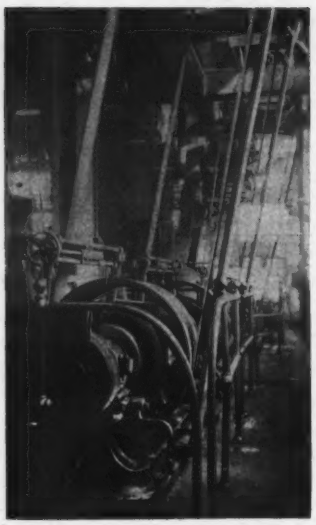
Paper Machine Drives

The starting characteristics of paper machines are such as to require a torque of from two to ten times that required under normal running conditions. For instance, in the large Kraft machines, even when fitted with anti-friction bearings, the friction load at the time of starting may be ten times the running load. One of the manufacturers of papermaking machinery states that the starting torque required to turn over his machines compared to the running torque in the different sections of the machines usually falls within the following limits:

Couch and press sections . . .	1½ to 2
Driers	4 to 6½
Calenders	4 to 6½
Winders	2 to 2½

These starting characteristics must be taken into consideration when designing the proper drives for the machine.

Leather Belt Drives on 1400 F.P.M. Newsprint Machine



Paper Mill Drives Tapered Cone Pulleys

The three most difficult drives on paper machines are usually those of the couch, the dual press, and calender. If the torque on these sections of heavy board machines were to remain constant, the horsepower requirements would vary directly as the speed. Actually, however, due to the heavy weight of the paper and the inertia of the section, the torque increases approximately 25% at the minimum paper speeds. To illustrate, on a machine where the ratio between maximum and minimum paper speeds is six, and where the maximum paper speed is 1,200 fpm. and requires 280 hp. on the couch, the power requirements at the minimum speed of 200 fpm. will not be 280 divided by 6 (the speed ratio) or 46.7, but 58 hp., an increase of 25% over the expected value. The drive must be designed accordingly. The horsepower requirements in the other sections of the machine will vary in direct proportion to the speed of draw.

The calender drives are difficult because at some time or other the paper may come through the press to the calenders a trifle loose on one edge, thereby necessitating the calender pulling the last drier section. It is therefore advisable in laying out a calender drive to make it ample to carry not only the calender itself, but also the drier section. When it is considered that on some machines the drier rolls weigh in the neighborhood of 100 tons, some realization can be obtained of the excess load the calender drive may at some times be required to pull.

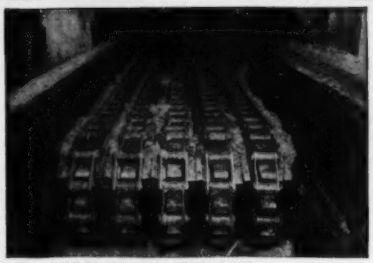
Cone Belt Drives

The paper machine cone drives with flat belts provide a means of transmitting power to different sections of a paper machine at different speeds from one line shaft operating at constant speed. Both the driving and the driven pulleys are cones having the same taper per foot but extending in opposite directions. Accurate speed control is obtained by the use of a belt shifter.

The cone drive requires the use of belts having certain requirements such as high coefficient of friction, extreme flexibility, maximum elasticity, high

"IF THIS CHAIN BELT COST *TWICE AS MUCH*— IT WOULD STILL BE WORTH IT," I TOLD HIM

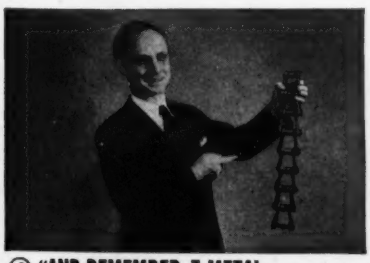
HE AGREED... AFTER HE TRIED Z-METAL CHAIN BELT!



① **"TAKE THIS CONVEYOR,"** I said. "You said you've had a lot of trouble with it this season. Actually, you've had much maintenance and 'pampering' that you could eliminate if you would install Z-Metal chain belt.

② **"YES, BUT Z-METAL CHAIN BELTS** cost more," he said. "Sure they do," I agreed, "but look what you're getting—over 25% greater strength than malleable, far more resistance to abrasion and corrosion.

③ **"THIS DUROBAR CHAIN BELT** made in Rex Z-Metal will wear far less than ordinary chain belt. Z-Metal's high Brinell hardness makes this chain belt second to none for service under exposed conditions.



④ **"AND REMEMBER, Z-METAL** chain belts are available in the same patterns as malleable chain belts. New sprockets are not necessary. You can make the change-over with minimum delay—even over the week-end if you have to.

⑤ **"Z-METAL ON YOUR CONVEYORS,** and Rex roller chain belts like these on your drives, are the best insurance I've ever heard of for uninterrupted production schedules. Better investigate these roller chain belts, too!

⑥ **"IT SOUNDED TOO GOOD,"** he told me a few months later. "But Rex Durobar Z-Metal chain belts were just what I needed on that conveyor, and your roller chain belt drives are the smoothest operating I've ever seen."

P.S. *If your malleable chain belts are not giving the service you'd like, if steel chain belts are too expensive, investigate Rex Z-Metal today. Write for folder "How To Cut Plant Operating Costs." Also ask about Rex roller chain belts mentioned in this imaginary conversation. Address, Chain Belt Company, 1605 W. Bruce St., Milwaukee, Wisconsin.*

REX CHAIN BELTS

CHAIN BELT COMPANY OF MILWAUKEE

Baldwin-Duckworth Chain Belt Division, Springfield, Massachusetts • Worcester, Massachusetts
Rex Chain Belt and Conveyor Divisions, Milwaukee, Wisconsin

1891 50TH ANNIVERSARY REX CHAIN BELT COMPANY 1941

tensile strength, comparative freedom from stretch, the ability to run true, and enough lateral stiffness to shift properly. Any appreciable slippage, oscillation, or lateral creep on the part of the belt would result in either torn or wrinkled paper, neither of which can be tolerated. With these requirements it is readily understood why only the best of belting should be considered for cone drives. Experience has shown that almost without exception the best grades of leather belting are now considered the most economical and the standard for these drives.

In operation one of the cone pulleys tends to unduly stretch one edge of the belt, while the opposite edge is receiving similar treatment from the other cone. The resistance offered by the belt to lateral flexing tends to cause it to try to run at right angles to the surface of the cones, whereas the belt tension, which incidentally is greater than that encountered in the average drive, tends to cause it to run at right angles to the axis of the cones. The result is that the belt runs with a noticeable reverse curve, shown exaggerated in Fig. 1, but which is not objectionable as long as the belt is true-running.

Due to the taper of the cone pulleys, the width of the belt used on them must be limited. If the belt is too wide, too great a strain is placed on its edges. The older paper machines were equipped with cone pulleys having a taper of ¾ of an inch per foot of cone width. In the newer machines this taper has been reduced until now some of them have cone pulleys with tapers as low as ⅜ inch per foot of width. On these lesser tapered cones heavy three-ply leather belting 24 inches in width can be successfully used without over-stressing the belt edges.

The effect of using a belt too wide on a tapered cone pulley can be illustrated by the experience of one of the paper companies. A 10-inch heavy double-ply leather belt had given eight years of satisfactory performance on a cone drive. It was then replaced by a 12-inch heavy double leather belt. Instead of the 2-inch additional belt width giving the superior performance expected by the operator, the wider belt operating on the steep tapered pulleys proved a complete failure. After several costly shut-downs (which were of course appreciated by the operator) the belt was cut down to a 9-inch width. Whereas the 12-inch belt would not operate properly for any length of time, the 9-inch belt ran all right, but lasted only two years in contrast to the eight years of trouble-free performance of the 10-inch belt. This is evidence of the necessity and economy of using the right drive and the right belt for a job.

FIG. 1

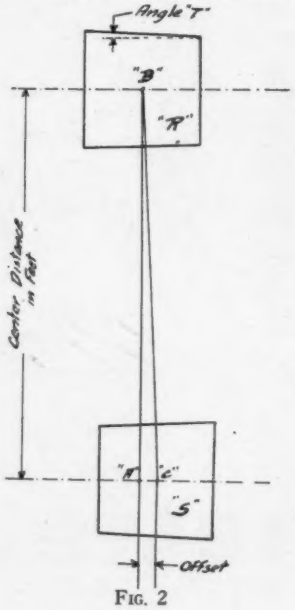


FIG. 2

Another example of the right belt width for a given taper was reported by one of the paper machine manufacturers. Trouble was encountered in the belt drives on one of the paper machines which he built. In this case, however, in place of changing the belt they decreased the taper of the cones and used the same belt with which they had encountered their previous trouble. With the reduced cone taper the old belt pulled the load satisfactorily and did not cause any more trouble.

From experiences similar to the above an attempt is being made by some belting manufacturers to get the taper of cone pulleys standardized and to reduce it to the lowest practical value. There is a movement under way to standardize the taper not on the basis of cone width, but rather cone diameter.

Although it is ordinarily good belting practice to use a thin, wide belt to transmit a given horsepower, the cone drive on a paper machine should be regarded as an exception. The wide, thin belt is generally preferable as it will flex around the pulleys more easily and presents a greater pulley contact surface. When a narrow, thick belt is run over small pulleys, the varrying strain between belt surfaces causes an excessive creep producing greater internal friction between the belt fibers and thereby decreasing belt life. In spite of this objection, in the case of tapered cone pulleys the usual procedure must be reversed, and a narrow, heavy belt recommended.

The flat leather belts used on tapered cone pulleys are almost without exception made endless. In order to eliminate as much stretch as possible, the belts are usually prestretched before being put into actual service. One common method is to install the belt on a pair of stretcher cones drawing it up as tight as possible, and running it under this tension for a number of days. The initial stretch is thereby removed, and when the belt is placed upon its regular drive cones again being drawn up as tight as possible, it will operate for months without being taken up. This is a type of service that is appreciated by paper mill men.

Belt Shifters

In order to hold the belt in a definite position on the cone pulley, guides bearing upon the edges of the belt have to be used. These guides subject the belt to further abuse, and they should, therefore, be designed so as to eliminate as much as possible friction and wear. Shifters were designed with roller bearings, but with the high belt speeds they did not work out so satisfactorily. Water cooled shifters are now giving very good performance in some of the southern mills.

The belt shifter can be moved very satisfactorily from a push button control operated from the front of the machine. A small electric motor is connected to the screws upon which are mounted the shifter forks. The control for the motor is run to the front of the machine, where the operator by simply pushing buttons can cause it to turn the screws in either direction, thereby practically instantaneously increasing or decreasing the rate of draw with the greatest

"Our *Clevelands* Have Run 24 Hours a Day Since 1924"

"Our first large installation of Cleveland Worm Gear Speed Reducers was made in 1924"—writes the Chief Engineer in one of America's largest Paper Manufacturing Plants.

"Seven Cleveland Units, installed in a complete new paper machine, have operated on continuous 24-hour service 300 days per year.

"Their excellent performance has led us to adopt Clevelands for many other applications—because when properly selected for the work they are to do, we find Clevelands give very satisfactory service."

That's putting the emphasis in the right place—conservative praise, backed up by years of repeat ordering! A list of Cleveland installations in your own Industry will reveal that again and again a few Cleveland Units were bought first for the tough spots, followed by orders for *more* Clevelands throughout the years.

Wouldn't you like to talk with a Cleveland Representative about correct applications of Worm Gearing on those new machines of *yours*?

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CLEVELAND WORM GEAR *Speed Reducers*

precision. Since each section of the machine has its own drive control, the machine can be run at top speed for each grade of paper produced, thereby obtaining maximum production at minimum cost.

Setting Taper Cones

The question as to the proper setting of tapered cones on paper machine drives can probably produce as many answers as there are operators. A simple, theoretical setting of the cones as recommended by T. B. Wood's Sons Company is shown in Fig. 2.

In this figure "B" and "C" are the centers of the faces of the driving and driven pulleys "R" and "S" respectively. The taper of the sides of the cones is indicated by the angle "T," which in turn is equal to the angle "ABC". The tangent of this angle is the amount of offset of the cones.

The simple method of determining the offset is:

1—Find the taper of the cones in inches per foot of width.

2—Multiply this taper in inches by the center distance between pulleys in feet.

3—The product of this multiplication is the offset in inches.

To illustrate, if the cones have a taper of ⅜-inch to the foot and the center distance is 16 feet, the offset in inches is ⅜ inch x 16 = 6.

It is found in actual practice when setting taper cones to the above formula that the offset obtained is usually slightly greater than that really required. It is best to figure on this much offset, however, when laying out the job, even if it is rarely ever needed. This applies to both open and crossed belts, although there may be a greater discrepancy between theory and practice for the crossed belts than for the open. The most important thing when setting cone pulleys is tension. The belt must not be too tight nor too loose, but just tight enough to pull the load. Tension, therefore, helps determine to a great extent the offset and wear.

New Thilmany Unit in Operation

APPLETON, Wis., November 24, 1941—Within the next week, the Thilmany Pulp and Paper Company, Kaukauna, Wis., will start operations in its new asphalt coating plant, recently completed. All equipment has been installed with the exception of a motor drive, which has been shipped and will arrive momentarily.

Two coating machines will be placed in operation, one 60-inch and one 120-inch. They were designed by Thilmany engineers and the frameworks were built and assembled by the company.

Approximately $70,000 was expended for the building and equipment, according to C. R. Seaborne, vice-president in charge of manufacture. The building is 50 by 170 feet in size, one story, made of concrete, brick and steel. It has large hammered glass windows for glare-proof light, and is equipped with drop lighting in the interior. The basement will provide 8,500 square feet of storage space.

Handling facilities have been provided through construction of a new railroad spur and a pump house for unloading tank cars. Existing sidetracks have been rearranged for better loading facilities, and a new ramp has been provided for trucks and freight cars.

Construction of a mixing room is now in progress, adjacent to the present asphalt building. It will be connected to the new building by a tunnel, and will contain feeder pipes through which asphalt mixture will be pumped. The pipes will be steam-jacketed to keep the solution from solidifying.

Concrete is now being poured for the foundations of another building to house the new No. 9 paper machine. It will be located adjacent to the bag factory at the lower mill, will be of monitor type construction, and will be 70 by 345 feet. It will also have hammered glass windows. Estimated cost of building and equipment is $500,000.

The unit containing the beaters and jordans will be two stories high, and the machine room will be one-story. Plans also include an overpass between the present wet machine room and the new machine room. To make room for the overpass, part of the walls and the roof of the construction shop building have been dismantled, and the shop has been moved to the garage building. Foundations will be of concrete, and the walls will be of brick, tile-lined. The stair well will be lighted by the use of glass brick walls.

The new paper machine will be of the Yankee type to trim 120 inches and will be equipped with a 12-foot dryer. It is being built by the Beloit Iron Works, along with auxiliary equipment. Partial delivery will be made in March, and the remainder in June. The improvements are being made for economy of production rather than increased output, Mr. Seaborne says. The new machine is designed to produce a tonnage equal to that now made on the No. 3 and 4 machines combined. These latter eventually will be dismantled.

It is estimated that the new building will be completed early in January. The Permanent Construction Company, Milwaukee, Wis., is doing the construction work, and also erected the asphalt building.

De Laval Turbo-Alternator

A leaflet, Publication E-1215, issued by the De Laval Steam Turbine Company, Trenton, N. J., describes a directly connected turbo-alternator set supplied to the Municipal Plant at Wyandotte, Mich. This unit, which is rated at 4000 kw. (5000 kw. maximum), generates 60 cycle current at 4800 volts and is designed to operate in parallel with an older 2000 kw. unit and with purchased power. The 19-stage turbine runs at 3600 r.p.m. and uses steam at 425 lb. per square inch., 720 degrees F., exhausting to a 28½ inch vacuum. In addition are three extraction points from which steam can be drawn for feed heating and for heating the building. The steam rate at full load was guaranteed to be 9.9 per k.w. hour.

Various improvements described in the leaflet contribute to the reliability, close speed regulation and high efficiency. The speed governing arrangement, which incorporates two stages of hydraulic amplification, is described in detail. A second unit of the same type, but rated at 7500 kva. and guaranteed to use not more than 9.57 lb. per k.w. hour at 6000 k.w. load, has since been contracted for by the city.

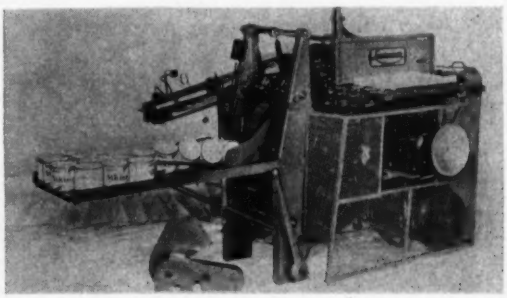
The building of large units of this type is a new departure for De Laval and introduces a new source of supply, particularly for industrial plants requiring efficient, modernized equipment of this character. The De Laval Steam Turbine Company has previously supplied quite a few turbines directly geared to paper machines and for D. C. power supply in paper mills.

Lawtomatic Roll Wrapper

A recent contribution to the paper industry, the Lawtomatic Roll Wrapper, was displayed last month in Green Bay, Wis., during the annual meeting of the Northwestern division of the American Pulp and Paper Mill Superintendents Association.

Under the direction of sales manager Larry Vincent, the model on display, which took up little more floor space than an office desk, turned out 'Lawtomatic' toilet tissue, wrapped, sealed and ready for packing, at the rate of 34 rolls per minute.

Four models of the Lawtomatic Roll Wrapper are now available, according to Vincent. In addition to the Junior toilet roll wrapper exhibited at the Green Bay convention, the Lawton company is producing



NEW ROLL WRAPPER

a senior toilet roll wrapper, with a speed capacity of 55 rolls per minute; a senior roll towel wrapper and a junior roll towel wrapper, with capacities of 40 and 26 rolls per minute respectively.

The Lawton company asserts that the principle of the mechanism involved in their roll wrappers can be utilized for any paper product that has a round, hollow core.

However, up to the present, only machines for wrapping of toilet tissue and toweling have been introduced to the paper industry by the local company. Main difference between the senior and junior models lies in speed capacity; both types of machine are radical in that they are faster, lighter and take up less space than the cumbersome wrapping machines than heretofore available to the industry.

Invented by Mr. A. W. Witbro of Green Bay, the machine was developed in 1940 in the Lawton shops and production and sale undertaken by the De Pere concern.

Since January 1 of this year, when an intensive sales campaign was inaugurated, which will eventually familiarize paper mills from coast to coast with the Lawtomatic Roll Wrapper, more than 20 mills have adopted Lawtomatics.

Paper Stock Firm Buys Building

KANSAS CITY, Mo., November 10, 1941—Frank E. Wilcox, president of the Industrial Paper Stock Company, 136 Main street, has announced the purchase by his company of an adjoining building at 140 Main street from the Burton estate.

The property, a 3-story brick structure with basement which has a Main street frontage of 65 feet and is 105 feet deep, has been occupied by the company under lease for the last two years.

Two years ago the company purchased a plant in Topeka, and last year acquired the property it operates in St. Joseph.

There's a Size and Type of L-R Flexible Coupling for the most efficient CORRECTION OF MISALIGNMENT in small pumps to heaviest duty machinery in paper and pulp mills. Quick delivery assured. Send *now* for Catalog and Selector Charts. Any millwright can install. Insure smooth, continuous performance in *your* plant.

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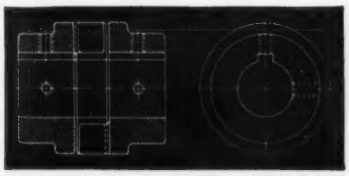
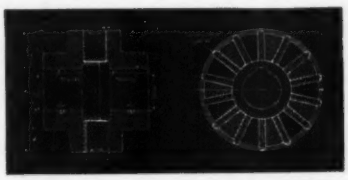
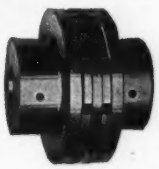
For small machines.
Semi-steel and brass. 3/16" to 2¼" bore. 1/6 to 50 H.P. at 1750 R.P.M.







TYPE W
General Service. Bore sizes 1½" to 16¾" for loads from 2 to 2500 H.P. at 100 R.P.M. Non-lubricating, cushions visible, easily replaceable.

TYPE H
Extra-Heavy Duty. 1½" to 9½" bore. For loads 4.6 to 806 H.P. at 100 R.P.M.

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For Diesels and Heavy Duty. Bolts directly to flywheel, clutch or drum. Save up to 1/3 space. 1⅝" to 16¾" bores. For loads 1.5 to 2500 H.P. at 100 R.P.M.

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Bowater's Erects New Sulphite Pulp Mill And Greatly Increases Output

An important expansion of the production facilities of Bowater's Newfoundland Pulp and Paper Mills Limited, Corner Brook, Newfoundland, was completed this year. The new unit is a sulphite pulp mill with a daily capacity of 100 tons, which rate of production has been substantially exceeded in the six month period it has been in operation.

The new plant was formally opened on March 20, 1941, by the Governor of Newfoundland, Vice-Admiral Sir Humphrey Walwyn. It was erected through an agreement between the Newfoundland Government and Bowater's Newfoundland Pulp and Paper Mills, Limited. The original plan called for the completion of the plant at the end of this year, but at the outbreak of the European war it was decided to complete the mill at the earliest practicable date.

Visit U. S. and Canadian Mills

Before construction was started, engineers and technicians of the company visited many of the leading pulp and paper mills in the United States, Canada, and Scandinavia, to obtain the latest information on equipment and operation.

The entire work was done by the company's own staff, assisted by the English organization. The erection of this modern mill required 1,000 tons of steel, 1,500 driven piles and over 10,000 cubic yards of concrete. The roof area covers 50,000 square feet; the roof decks being of precast Haydite slabs, with 1-inch wallboard insulation over the slabs, and covered with 4-ply pitch and gravel roofing.

The walls of the building are formed of double hollow tile, with a low coefficient of heat transmission. All the buildings are carried on creosited piling. Transite pipe, with rubber lined fittings are used for all stock and white water lines. To provide as complete automatic operation as practicable, recording and controlling instruments were installed throughout. This equipment includes level recorders, consistency and steam controllers and many other installations for the precise control of the various mill processes and the quality of product. Improved laboratory equipment has also been installed. A large part of the material for the new mill was manufactured in England and was delivered after the outbreak of the war, without loss of any equipment.

Alterations Made in Power Plant

To provide the necessary motive power for the different departments of the new sulphite extension, extensive alterations were required in the main substation, to divert some 4,000 k.w. previously used to produce steam, to motive power. This made it necessary to install an additional 5,500 kva interrupting capacity. Through these switches power is distributed to two auxiliary substations, one for the sulphite machine room, and the other for the barking plant. Both auxiliary substations are equipped with the most modern truck type, metal clad switchgear, and oil immersed air-cooled transformers.

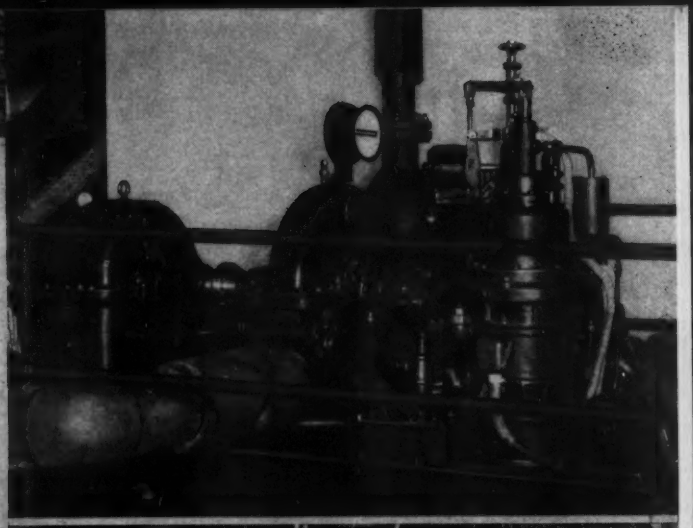
Motor equipment includes 200 motors, with starters, distribution centers and cabling, ranging in size from 1 hp. up to 250 hp. Lighting throughout was designed to provide modern standard lighting intensities.

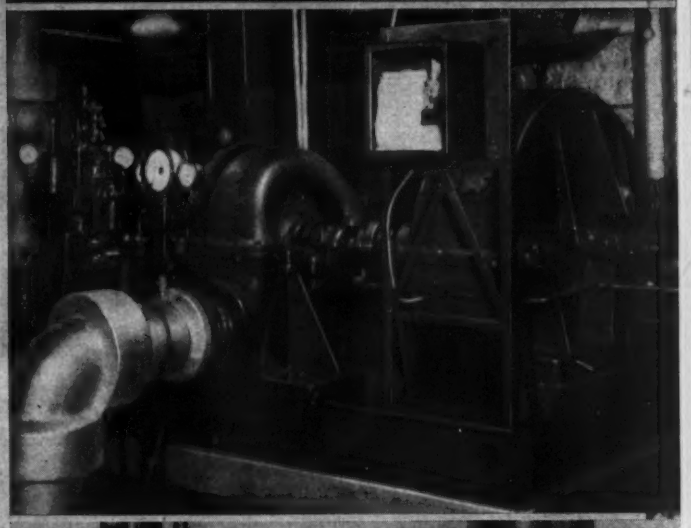
In addition to the new equipment in the sulphite mill, plans included a new wood handling plant, a new steam plant, with bark burning, machine shop, etc., with improved facilities for storing and shipping the product and for storing raw materials.

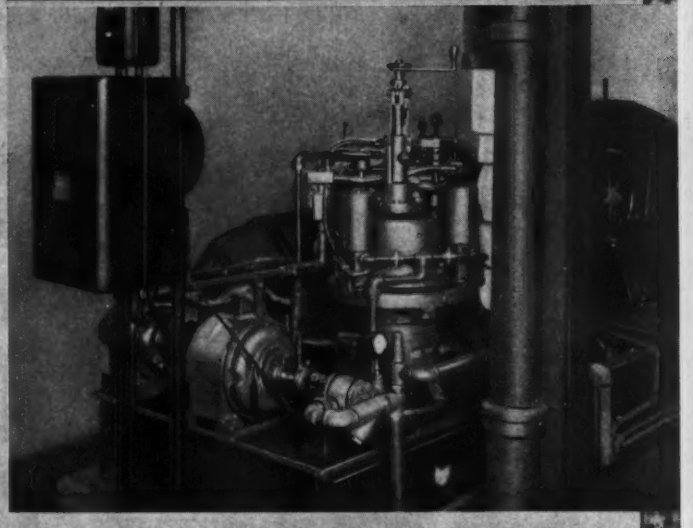
New Boilers Installed

The original steam plant consisted of two electric

PAPER BREAKAGE TOO FREQUENT? —better consider G-E turbine drives







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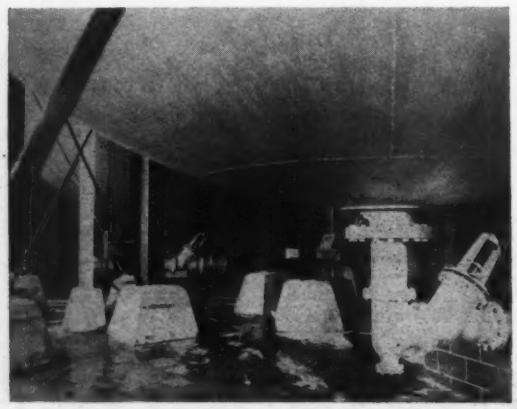
boilers of 25,000 kilowatts each, and four B. & W. water tube, stoker-fired boilers of 500 hp. each. Due to speeding up of the paper machines and increases in motive power load for grinders and other equipment, the quantity of power available for raising steam was decreased and the coal burning equipment had to be used continuously. Recent mill extensions have resulted in the lengthening of the original boiler house about one hundred feet, and two Foster Wheeler "S-A" water tube boilers, each with a rated capacity of 80,000 lbs. of steam per hour continuously, and 150 lbs. per square inch working pressure, have been installed. The designed pressure is 200 lbs. per square inch.

The boilers have each two burners supplied by individual exhausters and in low loads only one burner is used. Heated air for the pulverizers and for combustion is provided by air heaters of the tubular type, the hot fuel gases from the furnaces being drawn through the heaters by the induced draft fans and the fresh air to be heated is blown across the heater by forced draft fans; individual fans being used for each boiler. These heaters have a heating surface of 9,225 square feet each, and the temperature of the air supplied to the furnace averages 450 degrees F.

In addition to burning coal the new boilers will dispose of all the bark and mill refuse. Across the back of each boiler is a triple section Hofft furnace, which can be temporarily isolated from the main furnaces by a light wall during the winter months when there is no bark available. During the barking season, the bark from the drum barkers will be reclaimed from the mill sewer, and passed through presses, which will reduce the moisture content to approximately 65%. From the presses it will be delivered to a hog, which in turn, delivers it to a charger, when it is delivered by a blower through a 12-inch pipe several hundred feet long, to large bins above the Hofft furnaces, from whence it is fed at any required rate to the furnaces. The estimated amount of bark available is approximately twelve tons per hour during the barking season, and should produce steam equivalent to the burning of 10,000 tons of coal per year.

Acid Plant and Digester Capacity Increased

The installation of new equipment in the acid plant and digester building has increased the capacity from 140 tons of pulp per day to 250 tons. This



High and Low Pressure Hot Acid Accumulators, Sulphite Mill

Electric Boilers, Steam Plant

equipment includes one additional rotary sulphur burner and a completely new combustion chamber, 10 feet in diameter, by 27 feet long, lined with 12-inch fire brick. A new 9 feet Jenssen tower, and extensions to existing coolers has also been added.

The new equipment added this year includes one high pressure and one low pressure accumulator, each 32 feet in diameter. Two new digesters, 17½ feet by 51 feet, with a 60 degree bottom cone, were installed. This provides eight digesters, four of which are available for newsprint and four for the manufacture of sulphite pulp for export.

The digesters are supplied with a B. & W. chip packer, and both old and new digesters are provided with Schauffelberger circulating systems, without heaters.

It was decided to attempt some improvements over the long established methods of blowing and washing pulp. This was accomplished by constructing for the export side, a blow tank 90 feet long, 40 feet wide and 12 feet deep, with a capacity of 40 tons. Four passes are provided in this tank, equipped with 54-inch stainless steel propellor agitators, which carry the stock from one pass to the next.

Four digesters are connected by one 14-inch C.N.S. blow header, to the blow tank. The digesters are blown at very low pressures and water is added during the blowing period. The first pass of the blow tank, into which the stock is discharged, is lined with blow-pit tile; the other passes are lined

Circulating Pump and Piping, Sulphite Mill

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DRIVES

with plate tile. It is expected that this method of blowing will materially reduce dirt and improve the strength of the pulp.

Two Screening Systems in Use

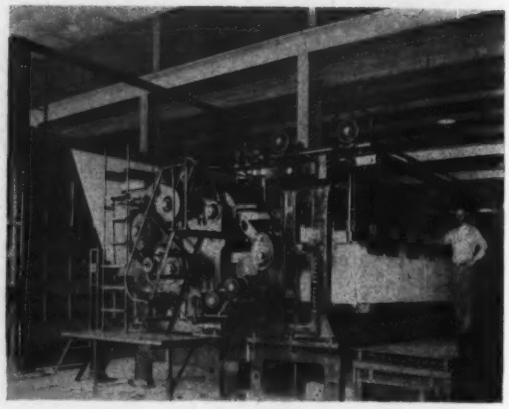
A separate screening system, entirely separate from the newsprint pulp, has been provided for the manufacture of pulp for export. From the blow tank the stock is pumped to two 6 feet by 10 feet Sherbrooke rotary vacuum washers. These washers are provided with stainless steel drums and covers and are operated in series, but by means of by-passes one or two washers can be used as desired. The vats are of concrete, lined with plate tile. The new method of washing has proven most successful.

Following washing and dilution, the pulp is fed to flat screen knotters, consisting of two lines of 28 plates each; the cut of these plates being 25 and 30. From the knotters the stock flows over 8 tile lined rifflers, 6½ feet wide and 60 feet long. From the rifflers it is pumped to three rotary screens equipped with 45 thousandths plates. The accepted stock from these rotary screens is sent direct to two 6-feet by 10-feet rotary vacuum filters, with the tile lined steel vats. The rejections from the rotary screens are sent to several lines of flat screens, each line containing 28 plates. Five lines of flats, equipped with 9, 8, and 7 cut plates, are used for the secondary stage screening, while the third, or tailing line, is equipped with 8, 7, and 6 cut plates. Screen plates are of stainless steel, chromium plate and bronze, as it was considered advisable to use some bronze plates until the proper cut of plate had been fully decided.

The accepted stock from the secondary screens goes to the thickeners, along with the stock from the rotaries. From the thickeners, the stock is regulated and pumped to the machine chest, which is a 30-ton tile lined tank, consisting of three passes and equipped with 54-inch bronze propellor agitators. From this chest the stock is again regulated by means of a Foxboro consistency controller and pumped to the pulp machine.

Pulp Drying Machine

A regular Fourdrinier wet end made by Walmsleys, is used for drying the pulp. The wire is 162 inches wide and 85 feet long. The machine is equipped with 36 table rolls 6 inches in diameter, suction couch, three plain heavy duty presses, and two pre-driers installed between the 2nd and 3rd



Cutting and Stacking Pulp, Sulphite Mill

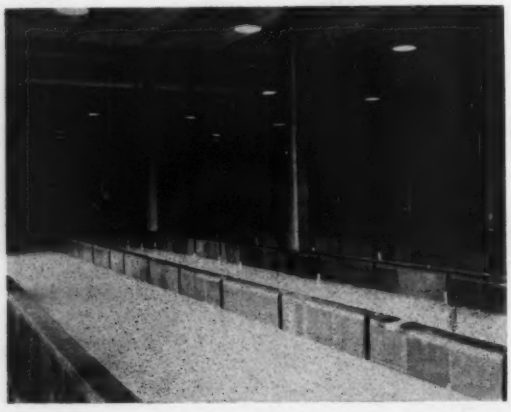
presses. A complete Harland drive incorporating all the latest improvements, provides the motive power and regulation of the machine at all speeds between 40 and 200 feet per minute.

The sheet passes from the third press into a Flakt drier, which is 116 feet long and 12½ feet high, where the sheet passes back and forth nine times. Drying is done by means of heated air and the drier is equipped with an economizer where the air is heated for the drier and for conditioning the building.

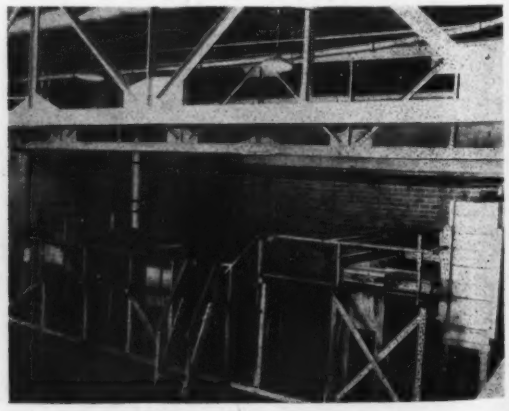
From the Flakt drier the pulp sheet passes to a Hamblet cutter, equipped with an automatic layboy, where the sheets are cut into sizes of 25 inches by 30 inches. This cutter is also designed for making wrapper sheets. When the layboy is full, the piles are pushed out by a ram onto a Matthews Pallet conveyor. The pulp is dried to around 10% moisture, made up into 450 pound bales and pressed and tied with wire in a Baldwin Southwark 600 ton press. The finished bales are stowed on skids and moved by electric lift trucks to the warehouse for storing. The crew required to operate the pulp drying machine consists of six men per shift, including the electric truck operator.

Modern Wood Handling Equipment

The completion of the new sulphite mill and increased production of newsprint made the original wood handling equipment inadequate for present day needs. The present consumption of wood is approxi-



Tile Lined Rifflers, Sulphite Mill



Vaccum Washers, Sulphite Mill

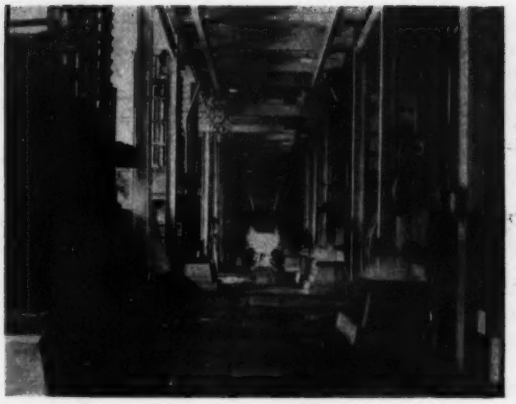
mately 1,000 cords daily, and during the summer months the wood cut during the preceding year has been brought to the mill. Approximately 60% of wood received goes to the storage piles after passing through the barking drums. During the winter, wood from the piles is passed through washing drums and cleaning equipment on its way to the chippers and grinders. In the whole layout, careful consideration was given to the flexibility of the wood supply, which is received by rail, boat, and towing, and the species vary considerably.

The main boom is moored to clusters of 75 feet cresoted southern pine piles. Each cluster consists of 25 or 30 piles, arranged in a semi-circle forming the outer boundary of the log pond. The location of the pond and jackladders has been selected to get the full benefit of prevailing winds. The log pond has a capacity of 3,000 cords of loose wood, but with favorable tides and winds will hold considerably more. The pond is divided into sections, which makes it possible to handle different species of wood from each section at the same time, and to separate this wood through the system. The wood is delivered to the pond in 4 feet lengths. The diameters are small and barking is sometimes very difficult, particularly with rail wood which is not in the water very long.

In handling the wood from the pond, two jackladders, each 6 feet wide, are used. The channels leading to the jackladders are bell shaped and lined with sheet piling. Tubes have been built underneath the jackladder, in which a motor driven 54-inch ship's propellor is installed. The propellor produces a strong current, which pulls in the wood from a distance of more than 100 feet in front of the jackladders. By means of water jets located on the walkbooms to produce a surface current, wood can be moved from distances considerably in excess of 100 feet. Each jackladder has a capacity of 75 cords per hour, and both are operated by four men per shift. The jackladders discharge into two separate conveyors feeding the drums. When using sap peeled or rossed wood, either conveyor can by-pass the drums entirely or can supply one or other bank of drums as required.

Barking Drums of Trunnion Type

The new barking drums are 12 feet by 45 feet, of the trunnion type, running at six revolutions per minute. One bank consists of three drums and the other of two drums. The capacity varies from 12 to 30 cords per hour each, depending on the condition of the wood when it is barked. The wood is discharged from the drums onto two 72-inch belt conveyors, where sorting is done. New equipment installed for cleaning wood consists of wood peckers, rossers, knot borers, saws, etc. Two new chippers, one ten knife and the other twelve knife, have also been installed.

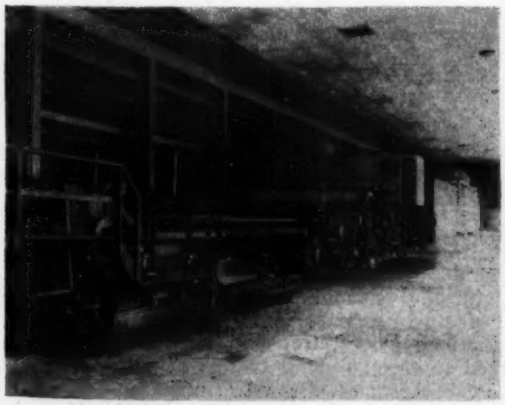


Grinder Room, Newsprint Mill

The storage conveyors are so arranged that during a portion of the year, wood is carried in both directions at the same time. New wood to be stacked, goes on the top section, and wood taken from the piles is brought in on the bottom section.

The wood piles have a capacity of over 200,000 cords. Two of the piles have movable steel stackers, stowing wood 125 feet high. On the 3rd storage pile there are two concrete towers 124 feet high, with an endless cable suspended between them.

By means of five cable conveyors at ground level, reclaiming wood from the piles can be easily loaded by a few men. In the winter, considerable quantity of dynamite is used. This is fired electrically and charges are placed in boxes which are installed underneath the piles near the ground. This permits a more economical use of dynamite and results in better slides of wood. For handling wood located at some distance from the conveyors, Diesel powered cranes with wood grabs are used. These cranes, to-



Wet End and Flakt Drier Pulp Machine, Sulphite Mill

Winders for 234-inch Paper Machines, Newsprint Mill

gether with four or five men can easily reclaim 500 to 600 cords in an eight-hour shift. In the old wood room, four 10 feet by 30 feet barking drums have been left to use as washing drums for the wood from the pile in winter. Warm water showers are used to remove ice and dirt from the wood.

Expansion in Newsprint Mill

When the mills at Corner Brook were opened in 1925, the paper machines were designed for a speed of 800 feet per minute giving an estimated capacity of 400 tons of newsprint daily. Many improvements have been added and at the present time the four 234-inch paper machines are operating at 1,200 feet per minute, and the rated capacity of the mill is 665 tons per day. On many occasions this rate has been exceeded and over 700 tons have been made. The agreement with the Newfoundland Government calls for increasing capacity of the newsprint paper machine to 204,000 tons per year. At the present rate of output this amount is expected to be secured without difficulty.

To improve the quality of product and efficiency of operations, a large amount of money has been spent in recent years. Improvements have been added to the electric drives on the paper machines, such as the installation of voltage regulators and larger couch motors. The increased newsprint production has been dried on the same number of dryers originally installed, increased drying capacity having been increased through improved ventilation and the addition of booster fans on the dryer felts.

From the original installation of 18 continuous grinders, the grinding room has expanded and now contains 29 grinders and the groundwood screen room has 28 deckers and 5 vacuum filters. Five Haug refiners have been installed to reduce waste and considerable improvement has been made in closing up the white water system. New mixing machines have been installed, as well as more efficient layouts for color, alum and clay mixing.

To meet the increased production demanded by the war, it has been necessary to provide an extension to the finishing room where three lines of rolls are finished at one time. Many of the improvements made in connection with the new sulphite mill were also necessary for the continued efficient operation of the newsprint mill at the present high rate of production. With these modern improvements completed, the Corner Brook Mill is better equipped than ever to maintain its position as one of the leading newsprint and sulphite pulp producers on the Continent.

The entire production of the Corner Brook Mills, with the exception of a small quantity disposed of locally and in St. John's, is shipped to all parts of the world. This has required extensive storage and shipping facilities, which have been recently enlarged to handle the additional tonnage produced by the new sulphite pulp mill and the increased output of the newsprint paper machines. Three warehouses, each 600 feet long and 135 feet wide, were constructed connecting the mill and docks, having a total storage capacity of 60,000 tons of newsprint.

Each warehouse is equipped with a conveyor running down its center. Elevators lower rolls of paper from the finishing room and deposit them upon these conveyors, on which they are carried to the desired storage point, where they are lifted by overhead cranes. There are four overhead cranes, with a capacity of 1¼ tons, in each warehouse, two operating on each side of the center conveyor. Part of one of the warehouses has been utilized for the installation of a cutter producing sheet newsprint which is stored in the same warehouse. Sulphite pulp is delivered into warehouses by Elwell Parker electric trucks, and the bales are stored in 14 tiers high by overhead cranes.

The mill wharves have a continuous water frontage of 1,600 feet, with a mean depth of 28 feet at low tide. The company owns and operates seven vessels. During the period in winter when the port is closed by ice, the mill products are shipped by rail to Port Aux Basques, an ice-free port 140 miles distant. There a warehouse, with a storage capacity of 7,000 tons, and with a conveyor system and four overhead cranes, has been constructed.

Priorities and Valves

What are priorities? Whom do they affect and how? What are preference ratings? How can properly rated orders be secured?

These and many other questions with respect to the new Government regulations are completely answered in a concise accurate digest of Priorities, prepared by the Ohio Injector Company of Wadsworth, Ohio, for the guidance of its distributors and customers for O.I.C. bronze and iron industrial and marine valves.

The O.I.C. Priority manual is announced by P. M. Arnall, vice-president of the Ohio Injector Company, as O.I.C. "Dividend Number 1" under the company's new O.I.C. Mutual Sales Insurance Plan in which all O.I.C. Distributors and their salesmen automatically participate.

In a special trade announcement Mr. Arnall states:

"What are Priorities? Whom do they affect, and how? What are Preference Ratings? How can an O.I.C. Distributor establish the proper priority status of the orders he receives? How can he help his customers to get preference ratings, and secure for himself properly rated orders?

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J. G. McNaught Goes to Holyoke

John G. McNaught, well-known sales representative for the American Writing Paper Corporation in the New York Metropolitan area, has been transferred to their General Offices at Holyoke, Mass., where he becomes sales office manager.

Mr. McNaught assumes his new duties December 1 and will immediately transfer his residence to 64 Harvard street, Holyoke.

Complete New Power Unit at Tama

Installation of Modern Boiler and Turbine in the Iowa Plant of The Central Fibre Products Company Clears Way For Greater Tonnage and Various Economies—Design Gives Every Consideration to Continuity of Operation.

By Samuel Blum, Engineer, H. M. Wilson Co.

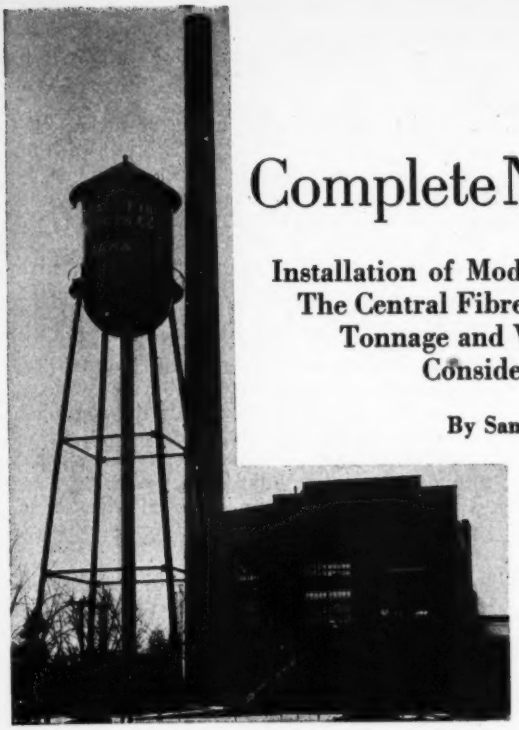


FIG. 1
Exterior View of Power Plant

Increased production is the common goal of every enterprising paper mill, for it is generally appreciated that the numerous fixed cost items associated with the manufacturing process, when divided by greater tonnage; tend to reduce the cost-per-ton of the entire output.

Most mills can, with relatively minor and inexpensive changes, step up production to a marked degree. There are such measures for instance as the addition of suction rolls; the addition of driers; the installation of better ventilation or an absorption system; improvement of drainage system or the speeding up of the entire machine. At some point along the line however a major limiting factor may be encountered which involves an expenditure which may be out of proportion to the returns which the increased production would yield.

Such was the condition which confronted the Tama mill of the Central Fibre Products Company; located at Tama, Iowa. The one 92 inch engine-driven machine produced an average of 80 tons of paper board daily.

Power and Steam Plant Limits Production

This production could, with some modifications and additions, be stepped up to 100 tons daily if it was not for the limitations imposed by the existing steam and power plant. Such greater production would require that the existing boilers be forced beyond advisable ratings, and any additional current requirements be purchased.

Steam was produced at 160 lb. on three Geary straight tube boilers, rated at 300 hp. and fired by chain grate stokers. All three boilers operated at approximately 150 per cent of rating normally and 165 per cent during winter weather.

With boilers 25 years old, any attempt to force greater capacity would have resulted in more frequent shut-down and loss in efficiency.

Current was produced on two engine generators; one a Murray Cross Compound unit, rated at 400-kw., and equipped with condenser; the other an Allis-Chalmers single cylinder machine, rated at 240-kw., and exhausting at 20 to 30 lb. to the paper machine. These engines were excellently maintained and produced about 75 per cent of the power needs; the balance being purchased from the power company.

Different Possibilities Considered

Several possibilities were investigated with a view to obtaining increased steam output, and among these was the advisability of burning oil under the present boilers. This, though practical and low in first cost, did not prove economical. With oil at the best price then obtainable, the increase in fuel cost was prohibitive; and with the additional cost of purchased power, the charges more than offset the gain which could be realized from the increased tonnage. Nor did this arrangement make provision for the lowering of operating pressure which was inevitable because of the age of the boilers, and the more frequent outage which must be anticipated with harder use.

The installation of additional boiler capacity was

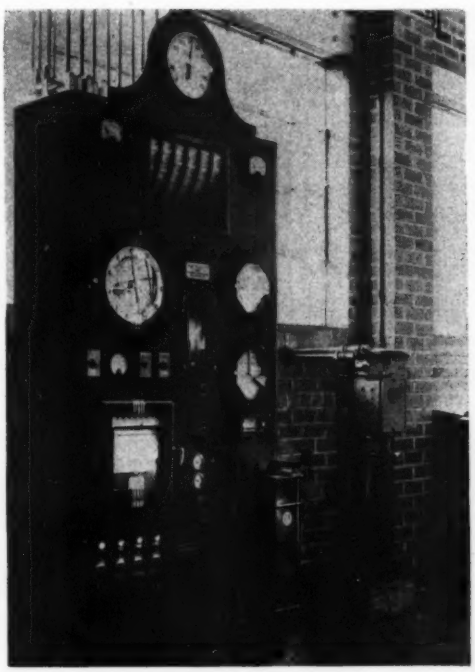


FIG. 2
Complete Information and Control are Centered on the Boiler Gauge Board

the next logical consideration. One new boiler of modern design could readily carry the entire load and operate at an appreciable saving in fuel. This would permit the existing boilers to remain as stand-by; and since they would seldom be used, their life as such could be prolonged indefinitely. Designed for higher pressure and future heat recovery, the new boiler would prepare the way for the installation of a turbo-generator at some later date when the current requirements became still greater or existing reciprocating units had to be discarded.

However, though additional steam capacity was desirable and new boiler equipment was inevitable, there was prospect of a very limited payoff on the capital expenditure required for this purpose. A boiler addition as contemplated, involved quite an expenditure; and in spite of the fact that improved efficiency would yield an appreciable saving in coal cost, this saving was not equal to the carrying charges on the cost of the improvements.

Final Design Includes Turbine

Additional savings could of course be made on the purchase of current and improvement of the steam balance; and once the boiler capacity was available, the proper application of a turbo-generator could be made to produce substantial returns. Increasing the capital expenditure in this case, to include the turbine equipment, more than trebled the savings which would be possible with a boiler alone.

The mill and equipment as a whole were well maintained and had a fine performance record; and these favorable conditions prompted the management to decide in favor of a program which would be complete, including boiler and turbo-generator.

Building Addition for Boiler

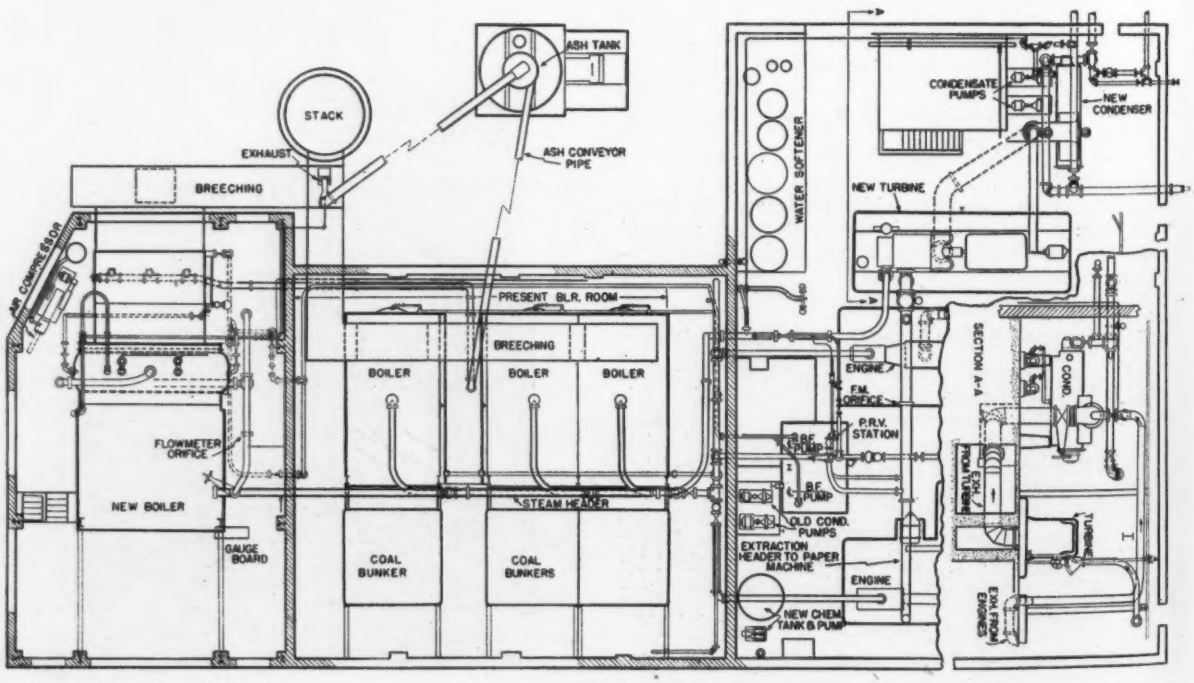
The building for housing the new boiler is an extension to the present boiler house; constructed of steel frame, concrete floors and roof; brick walls and steel sash. Simple ruggedness, spaciousness and ample daylight mark the design. A system of walkways and platforms on all sides of the boiler, with easy stairs provides ready access to all doors and parts, thus encouraging regular inspection and maintenance.

Boiler and Stoker

The boiler is a Springfield straight tube cross-drum sectional water tube type, with full water walls on sides, front and rear; superheater of the continuous loop convection type located in the upper deck and arranged for self-draining. The economizer is a bare tube counter flow design, built by the boiler manufacturer. Water walls and roof are backed with tile and insulation and the entire unit is fully steel encased. Furnace volume is proportioned.

The entire boiler unit, with all feed and steam piping, is designed for 410 lb. 125 deg. F. superheat, but, in order to utilize the existing feed pump equipment, the plant will for the time being operate at 275 lb.-125 deg. F. sh. The unit when producing the maximum plant steam requirements will operate at about 200 per cent of rating, but is designed to carry 250 per cent of rating with ease.

The stoker is a Coxe travelling grate type, 14 feet wide, 18 feet 5 inches long, with an effective area 259 square feet. Lower headers of the side walls form a clinker chill for the entire length of the stoker. It is driven by a constant speed motor through a 6 to 1 Reeves variable speed transmission which is actuated by the combustion control equipment. This stoker was selected to burn Iowa and Illinois bituminous screenings ranging in B.t.u. value from 9600 to 12,000 per lb.; moisture, 16 to 18 per cent; ash, 12 to 16 per cent; and sulphur, over 4 per cent.



Courtesy Power Plant Engineering.

FIG. 3

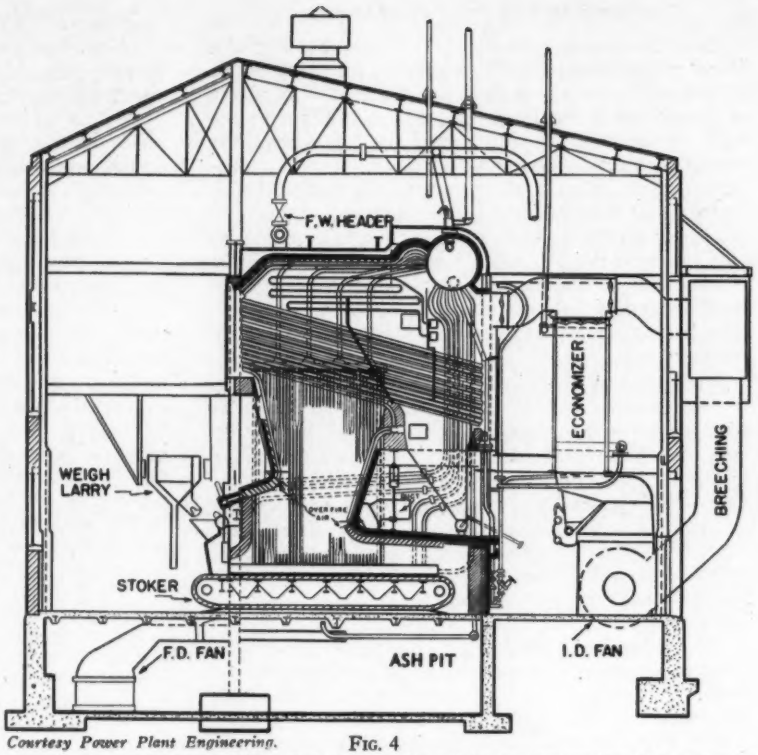
Plan Showing the New Boiler Room Extension, the Old Boiler Room and the Modernized Engine Room. In the Lower Right Hand Corner Is a Sectional Elevation Showing the Arrangement of the Surface Condenser

At maximum output the burning rate will not exceed 39 lb. per square foot of grate and the furnace volume provides for a maximum heat release not exceeding 42,000 B.t.u. per cubic foot.

Predicted efficiency at 250 lb. pressure with 10,130 B.t.u. coal is 82, 81.95 and 80.90 per cent respectively at ratings of 45,000, 60,000 and 75,000 lb. per hr. During recent tests, when operating at 45,000 lbs. and burning Iowa coal with 25% moisture and only 9,000 B.t.u.; efficiencies exceeding those predicted by the manufacturer were obtained.

Smoke Prevention Stressed

The long flame characteristic and high volatile content of this fuel make it unusually difficult to burn smokelessly. The furnace contour was designed particularly with this difficulty in view, and, to further insure smokeless operation, a system of overfire air jets, supplied from a separate blower, is provided at both front and rear arches. T. Z. steam jets are also provided at the front corners so the most satisfactory and economical operation can be obtained at any rating or with any type of coal. A McNeil smoke indicator is provided to give warning if adjustments are not right.



Courtesy Power Plant Engineering. FIG. 4

Cross Section of the New Boiler. Both Overfire Air and Steam Jets are Provided to Burn a Wide Variety of Iowa and Illinois Coal

Draft Equipment

Forced draft is provided by a Clarage double inlet fan, direct connected to a constant speed motor and provided with vortex control actuated from the combustion control systems. A separate blower provides air to the overfire jets. Induced draft is provided by a Sturtevant double inlet fan, direct connected to a variable speed motor; the controller being located on the gage board at the front of the boiler. Draft is varied at the boiler uptake damper under control of the furnace draft regulator, the fan speed being changed by the operator. This fan discharges into the existing 7 ft. diam. x 190 ft. high concrete stack. A bypass connection is provided direct from boiler outlet, past the economizer to the breeching, so in case of fan outage, the boiler alone could be operated on stack draft.

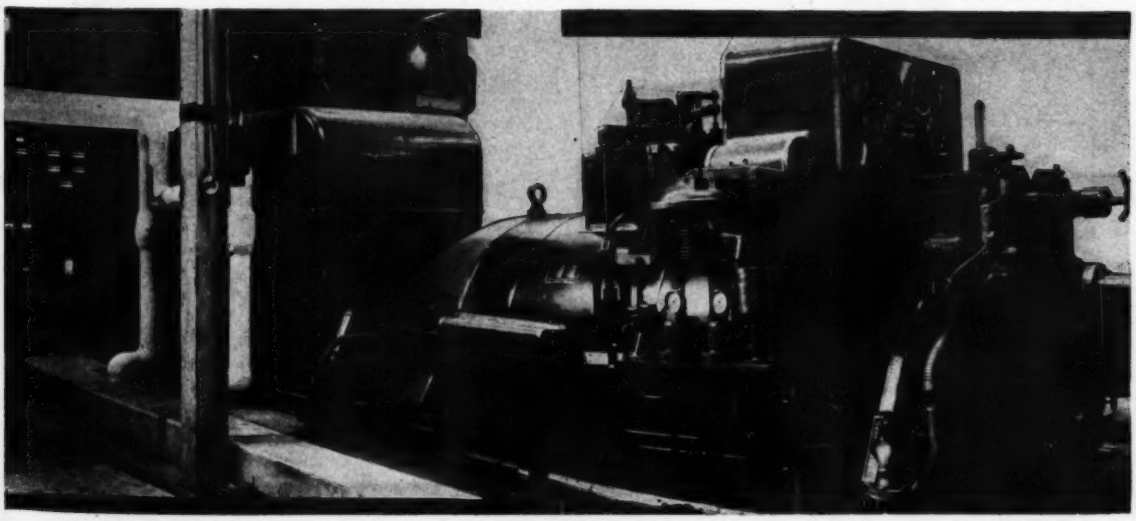


FIG. 5

Unusual Feature of the Turbo Generator Unit Is the Air Cooler Placed above the Generator and Built into a Streamlined Enclosure

Combustion and Feedwater Control

The combustion control system is the Republic-Smoot metering type, fully automatic, air operated. It is designed to maintain steam pressure at 3 lb. above or below pre-determined pressure setting; furnace draft within 0.02 in. of water of the pre-determined setting with load changes up to 20 per cent of maximum boiler capacity per minute; CO_2 within 1 per cent plus or minus of the pre-determined setting (12 to 13 per cent), except at widely fluctuating loads; smokelessness not to exceed Ringleman's No. 2 Chart at all ratings, allowance being made for separate overfire air which is not under control; and successfully handle operation between 25,000 and 75,000 lb. per hour.

A gage board located in front of the boiler contains all instruments and control adjustment points. On this board are mounted the pressure gage; recording gage for steam and feedwater pressure, six-pointer draft gage, steam flow meter, CO_2 recorder, six-point potentiometer, smoke indicator, drum controller for induced draft fan, and the combustion control devices. Lights and stop buttons for all motors are also available as well as ammeters for induced draft fan and stoker drives.

Water level in the boiler is held automatically by means of a Copes feedwater regulator; a constant differential pressure across the regulator being maintained by a Swartwout pump governor controlling the speed of the turbines driving the boiler feed pumps. Feedwater for the existing boilers, when these operate, will be supplied from the same pumps at lower pressure through a Fisher pressure reducing valve.

BEAUMONT

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Central Fibre Products Co.
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See Pages 75 & 76

Ohio Boxboard Co.
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Albermarle Paper Co.
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Manchester Board & Paper Co.
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Ash Hoppers & Gates

Continental Paper Co.
Ridgefield Park, N. Y.

BEAUMONT **BIRCH CO.**
1505 RACE STREET PHILADELPHIA, PA.

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Coal, Ash and Soot Handling

The existing coal handling equipment with storage bins in the old boiler house is retained intact. An electrically-operated weigh larry conveys the coal from these bins to the new boiler and provision is made in the new building design to accommodate additional bunker capacity later. Ash hoppers are equipped with specially designed Beaumont-Birch air-operated grates.

An existing steam jet ash conveyor was converted by United Conveyor Corporation to an intermittent type pneumatic system, which handles ashes from both the old and new boilers. A dustless unloader under the ash tank eliminates a dirt nuisance of long standing.

Boiler and economizer passes are equipped with Bayer valve-in-head type of soot blowers supplied with steam at about 160 lb. Two retracting gun type blowers under full boiler pressure are provided in the front wall for sweeping the bottom row of tubes which are arranged to form a slag screen. Siftings in the stoker wind boxes are removed by a specially designed system of steam jets.

Water Supply

Water supply for the boiler is obtained from a nearby lake. It is first pumped through a revolving screen into a reservoir, after which it is delivered to the mill through the turbine condenser. A branch for boiler feed purposes is passed through pressure filters and Permutit zeolite softeners to an existing Cochrane deærating heater and storage tank located on a platform well above the pumps and permitting feedwater temperatures up to 225 deg. F. Condensate returns are pumped through a Cochrane pressure oil filter before passing to the deærator. Supplementary treatment as recommended by Dearborn is added direct to the boiler through a pressure pump.

New Turbo-Generator

The turbo-generator unit is made up of a Murray turbine and Crocker-Wheeler generator, and is located in the present engine room. It is rated at 1500-kw. (1875 kv-a. at 0.80 per cent pf), but the turbine can deliver 2650 hp., sufficient for the full 1875 kv-a. at 1.0 pf. or 1875-kw. The turbine is designed for 450 lb.-750 deg. F. t.t., but will operate at present at 250 lb.- 125 deg. F. sh. Steam can be extracted between limits of 35 to 55 lb. and the exhaust is to a 1300 square foot I-R surface condenser.

By extracting at 55 lb., steam is made available after producing current; for every process need of the plant including the rotaries which require pressure at 45 lb., and every section of the driers at pressures varying up to 50 lb.

The new generator is connected to the main bus through an air circuit breaker. Normally this unit will supply all electrical requirements. Outside current, however, is being retained for down periods. As stand-by, the existing reciprocating units in conjunction with outside supply can carry on as before. A novel departure on the generator is the location of the air cooler. To avoid the basement, which would be required if the cooler was to be placed in the conventional place below; the cooler is built into a streamlined casing over the generator. A water-tight steel casing construction protects the windings in case of leakage.

Condenser Heats Process Water

That portion of the mill water used for beaters is passed through the condenser as circulating water, the quantity being controlled by means of a regulator actuated by the temperature leaving the condenser. The degree of vacuum is thus governed by the predetermined water temperature; the regulator varying the quantity of water depending on the steam flow to the condenser at any given electrical load. The water balance is maintained by means of an overhead surge tank with float valve make-up. Water passes from the condenser to a closed heater where it is further raised to the desired temperature. The regulator can be bypassed to obtain maximum condenser capacity. Exhaust from the present condensing engine is brought over and connected to the new condenser with valves so either the engine or turbine can be operated on it.

Reducing Valve Stations

The 55-lb. system, normally supplied from turbine extraction, is supplemented when necessary by a reducing valve from the 160 lb. mains. To take care of steam to the engines and reciprocating pumps, steam from the boilers is reduced and de-superheated by means of two Fisher-Stabilog operated reducing valves and an Elliott desuperheater. Steam for the boilerfeed pump turbines is delivered at full boiler pressure and temperature.

Conclusion

This project was designed by, and construction carried through under the supervision of, the H. M. Wilson Company, engineers of Philadelphia, with the helpful co-operation of the plant personnel. In the design every consideration was given to ease and continuity of operation, and every facility provided for efficient and economic operation.

Manufacturers of the Principal Equipment

Engineers	H. M. Wilson Co.
Boiler	Springfield Boiler Co.
Stoker	Combustion Engineering Co., Inc.
Ash hopper	Beaumont-Birch Co.
Weigh larry	Beaumont-Birch Co.
Ash handling	United Convevor Corp.
Feedwater regulator	Northern Equipment Co.
Steam jets	T. Z. Railway Equipment Co.
Pump governor	The Swartwout Co.
Non-return valve	The Edward Valve & Manufacturing Co.
I. D. fan	B. F. Sturtevant Co.
Overfire air fan	B. F. Sturtevant Co.
F. D. fan	Clarage Fan Co.
Water treatment	The Permutit Co.
Supp. B. water treatment	Dearborn Chemical Co.
Chemical pump for B. F.	Dearborn Chemical Co.
Soot blowers	The Bayer Co.
B. O. control	Consolidated Ashcroft Hancock Co., Inc.
Combustion control	Republic Flow Meters Co.
Gage board	Republic Flow Meters Co.
Stoker draft gauge	The Hays Corp.
Condensate meter	Philadelphia Meter Co.
Temperature Recorder	Leeds & Northrup Co.
CO_2 recorder	Leeds & Northrup Co.
Smoke Indicator	T. W. McNeill Eng. Equip. Co.
B. W. sample cooler	Cochrane Corp.
Low water alarm	Cochrane Corp.
Indicating gauges	Manning, Maxwell & Moore, Inc.
Mercury col.	Consolidated Ashcroft Hancock Co., Inc.
Aneroid barometer	Taylor Instrument Cos.
Pressure reducing valves	Fisher Governor Co.
Desuperheater	Elliott Co.
Desup. control	Foxboro Co.
Valves	The Lunkenheimer Co.
Pipe and fittings	Geo. B. Limbert Co.
Steam Traps	Fisher Governor Co.
Turbine	Murray Iron Works Co.
Generator	Crocker-Wheeler Elec. Mfg. Co.
Throttle and N. R. valves	Schutte & Koerting Co.
Condenser	Ingersoll-Rand Co.
Switchgear	General Electric Co.
Turbine monorail	Philadelphia Chain Block & Mfg. Co.
Expansion joints	Marquette Coppersmithing Co.
At. relief valve	Atwood & Morrill
Ext. relief valve	Cochrane Corp.
Con. water control	Fulton Sylphon Co.
Air compressor	Gardner-Denver Co.
Vacuum pump	Wagener Steam Pump Co.
Water supply pump	Dayton-Dowd Co.
Sump pump	Chicago Pump Co.
Water eductor	Schutte & Koerting Co.

New Water Pump Seal

In announcing the new Bellows-type Seal, the Crane Packing Company, 1800 Cuyler avenue, Chicago, manufacturers of "John Crane" Seals for more than a quarter century, list the following as principal features:

Seal has only 2 parts: bellows and spring. Bellows is an exclusive synthetic rubber compound found to be superior to any other for sealing services; grease, oils, salt water, alcohols and anti-freeze do not affect it.

Installed partially compressed; ready for instant seal.

Entire unit (bellows and spring) is spring driven and operates as a driving coupling. Seal does not touch or have a sliding contact with the shaft: rust, corrosion and deposit do not interfere with or reduce efficiency.

Bellows connects two flanged ends. Spring is placed in a fixed position against the inside shoulders of the flanged ends and so holds the contact facings against the sealing washer on the one end and the driving base on the other.

Because of the seal's ability to flex and compress as a unit, pressure variation, misalignment, fan thrust, torque or vibration set up by an unbalanced impeller, are automatically accommodated or compensated for.

The serrated contact facings are responsible for the positive seal at both the washer and driving base points. These facings are formed in a series of concentric grooves and flat-faced ribs, effecting seal with a suction-action.

Among other advantages is "blind-fold" installation. Seal cannot be installed wrong either on the assembly line or in the field. Both ends are identical —either end is right.

Samples and data will be furnished on request to automotive and industrial pump engineers and designers.

Spanish Paper Industry Expands

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., November 26, 1941—The Spanish paper manufacturing industry attained about 40 per cent of capacity during the second quarter of 1941, due to a further expansion of output of paper stock made from domestic raw materials, and a slight increase in the amounts of pulp wood being received from abroad.

Newsprint, wrapping, and other paper, however, are said not to be of good quality when produced of domestic materials. Need is so great however that the entire production is rapidly absorbed. Stocks of high grade book and writing papers are reported as quite small, with domestic production unable to meet the demand.

Reports from abroad to agencies of United States services say manufacturers in Spain are apprehensive that they may not be able to arrange deliveries of several hundred tons of woodpulp they had contracted for from northern European countries.

Paper Salvage in Canada

MONTREAL, Que., November 24, 1941—C. N. Moisan, president of the Quebec Division of the Canadian Manufacturers Association, in an address here urging co-operation in the paper salvage campaign, said that with importations of many grades of paper formerly imported from the United States and from overseas, Canada's paper industry is facing a crisis. All citizens, he said, should save every available scrap of paper and turn it over to charitable organizations for sale to paper manufacturers, Mr. Moisan maintained. Canadian paper production is struggling to meet current demands and the requirements are increasing steadily because of new war-created needs. Mr. Moisan is president of the Standard Paper Box, Ltd.

Since 1927—and Still Going Good

In the February 4, 1932, issue of PAPER TRADE JOURNAL there were printed several illustrations of equipment showing Rains Metallic Packing and giving the period of time since the pumps, etc. were packed.

FIG. 1

Original Caption—Centrifugal Pumps Run More Than Five Years With Semi-Metallic Packed Stuffing Boxes.
These Pumps Are Now In Operation 14 Years, Previously the Bronze Sleeves on These Pumps Required Replacing Every Four Years, but the Original Sleeves Are Still in Service.

The PAPER TRADE JOURNAL recently received information from A. E. Rains, general manager of Rains Wood Metal Packings that these packings were still in operation.

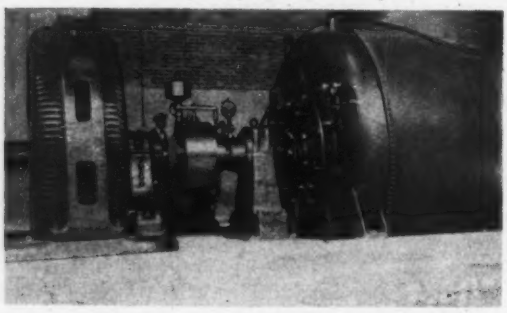


FIG. 2

Original Caption—Water Turbine Packed July 7, 1924 and Still in Continuous Service, with Excellent Stuffing Box Conditions and Every Indication of the Packing Lasting for Several More Years.
Now in Operation 15 Years.

FIG. 3

Original Caption—Pump Packed Nine Years Ago, Yet the Original Plungers Are Only Highly Polished and Show no Signs of Wear.
Pump Still in Service.

Reproduced here are the original illustrations with their captions and below them the further explanation as received from Mr. Rains.

With present conditions likely to exist, the importance of protecting rods and shafts cannot be overemphasized. In some of the instances illustrated the length of life added to these important pieces of equipment is as interesting as the long life of the packing.

J. O'Halloran Returns to Quebec

J. O'Halloran, chief engineer of Anglo-Canadian Paper Company, Quebec, lent to Wartime Merchant Shipping and assigned to Vancouver, will return to his Quebec company for a time at least, in response to an urgent call for his services on some pressing problems.

The rearrangement in Vancouver has made it possible to allow Mr. O'Halloran to return to Quebec. It is expected, however, that he will again be on the Wartime Shipping job.

Dixie-Vortex Votes Dividend

The Dixie-Vortex Company has declared a 25-cent dividend on the common stock. Payments for the year will total 75 cents including the current declaration, or 25 cents more than the previous year.

FIG. 4

Original Caption—Head of Centrifugal Pump Showing Condition of Semi-Metallic Packing Rings after Five Years of Uninterrupted Service. Even the Original Bronze Sleeves Are Still Intact.
Still in Service, About 14 Years.

U. S. Paper Bids Open at Higher Level

Prices Offered For Furnishing the Government Printing Office With Supplies For Three Months' Period Beginning January 1, In Some Cases Show 50 Per Cent Increase Over the Opening In May.

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON D. C., November 24, 1941—Bids were received today by the Joint Congressional Committee on Printing for paper for the use of the Government Printing Office for a three months period beginning January 1 next. Government officials said that in some cases the bids received were 50% higher than they were at the last bid opening.

It was originally intended to open the bids for a six months period which has been the usual time over the past few years but owing to the present emergency and paper shortage the contract time was cut to a three months period. Bids were received from 34 bidders, compared with 33 at the last opening in May.

The Joint committee will meet December 1 to consider the making of awards. In all cases the bids were for 60% of the original amount asked for by the Government Printing Office unless otherwise specified. The Printing Office cannot purchase more than 10% overrun instead of 50% as originally planned.

Special Notations

In addition to a number of specific notations there were certain special ones.

Walker Goulard Plehn, Inc., stipulated that on certain lots only 262,000 pounds total could be purchased on any or all of the following lots: 129, 141, 154, 155, 156, 161, 163 168, 169, 170, 171, 176, 177, 178, 180, 181, and 196.

Mudge Paper Company stipulated that the total tonnage on lots 12, 18, 20, 21, 22, 56, 58, 151 and 152, shall not be over 800,000 pounds.

Old Dominion Paper Company stipulated that on Lots 84, 126, 128, and 129 total tonnage shall not be over 30,000 pounds.

Virginia Paper Company stipulated that there shall only be 40,000 pounds from one or more from lots 106, 111, 121 and 123.

Mathers-Lamm Paper Company stipulated that total tonnage shall not exceed 30,000 pounds on Lots 154, 155, 156, 161, 162 and 190.

Frank Parsons Paper Company stipulated that the total tonnage shall not exceed 250,000 pounds on Lots 161, 162, 168, 169, 170, 171, 190 and 196.

Bids received were as follows:

The quantities given below are for the full amount called for in the original schedule. Because of later revision only 60 per cent of this amount will be required.

Newsprint

No. 1—3,000,000 lbs., 24x36—64; rolls, 19, 24, 28, 36, 38, and 48 ins. wide (3-inch fiber cores, weight of cores and wrappers shall be included in net weight).

National Pulp & Paper Co. (330,000 lbs. only)	2.90c
Paper Corp. of U. S.	3.53c

Machine-Finish Book

No. 3—600,000 lbs., 25x38—70; flat, cut 21½x31, 28x38, and 31¼x45½ ins.

Barton, Duer & Koch Paper So.	7.60c
Marquette Paper Co.	7.77c

No. 4—600,000 lbs., 25x38—70; flat, cut 24x38, 38x48 and 38x50 ins.

Frank Parsons Paper Co.	6.75c

No. 5—600,000 lbs., 25x38—70; flat, cut 24x38, 38x48 and 38x50 ins.

Marquette Paper Co.	6.75 c

No. 6—600,000 lbs., 25x38—70; rolls, 18, 21, and 28½ ins. wide (3-inch fiber cores).

Mudge Paper Co.	7.11c
Barton, Duer & Koch Paper Co.	7.24c
Northwest Paper Co.	7.26c

No. 7—800,000 lbs., 25x38—70; rolls, 19 and 38 ins. wide (3-inch fiber cores).

Paper Corp. of U. S.	7.4181c
Marquette Paper Co.	8.03c
Northwest Paper Co.	7.26c

No. 8—800,000 lbs., 25x38—70; rolls 19 and 38 ins. wide (3-inch fiber cores).

Barton, Duer & Koch Paper Co.	7.25c
Marquette Paper Co.	8.03c
Frank Parsons Paper Co.	6.40c
Northwest Paper Co.	7.25c

No. 9—600,000 lbs., 25x38—70; rolls, 24, 36, and 48 ins. wide (3-inch fiber cores).

Marquette Paper Co.	8.03c
Northwest Paper Co.	7.26c

No. 10—200,000 lbs. 25x38—80; rolls, 38 ins. wide (3-inch fiber cores).

Barton, Duer & Koch Paper Co.	6.92c
Marquette Paper Co.	7.05c
Frank Parsons Paper Co.	6.10c
Northwest Paper Co.	6.93c

No. 11—1,000,000 lbs., 25x38—80; flat, cut 24x38, 33¼x64, 38x48 and 38x 50 ins.

Mudge Paper Co.	7.19c

No. 12—1,000,000 lbs., 25x38—100; flat, cut 22¼x32¼, 24x38, 24¼x36¼, 31½x48, 32x42, 38x48 and 41x52 ins.

Mudge Paper Co.	7.15c
Mead Sales Co. (300,000 lbs. only)	6.94c
Stanford Paper Co. (300,000 lbs. only)	6.90c
Marquette Paper Co. (200,000 lbs. only)	7.40c

No. 13—40,000 lbs. 25x38—120 and 140; flat, cut 29x41, 32x52, and 38x48 ins. Min. order 5,000 lbs.

Barton, Duer & Koch Paper Co.	7.23c

No. 14—40,000 lbs., blue and salmon, 25x38—70 and 100; flat, cut 25x38 and 38x48 ins. Min. order, one color, 5,000 lbs.

No bids.

Machine-Finish Book End Paper

No. 18—200,000 lbs., for waste leaves: flat, cut 25x38—160; the grain to run the 38-inch way.

Mudge Paper Co.	7.80c
Marquette Paper Co.	9.46c

Offset Book

No. 20—1,500,000 lbs., 25x38—80; flat, cut 38x40 ins.

Mudge Paper Co.	8.42c
Marquette Paper Co. (600,000 lbs. only)	8.58c

No. 21—1,000,000 lbs., 25x38—100 and 120; flat, cut 24x38, 25x38, 26x32, 28x40, and 38x48 ins., grain as ordered.

Mudge Paper Co.	7.65c
Stanford Paper Co. (50,000 lbs. only)	8.71c
Paper Corp. of U. S. (120,000 lbs. only)	8.86c
(350,000 lbs. only)	8.05c
Marquette Paper Co. (250,000 lbs. only)	8.30c
(120,000 lbs. only)	8.85c
(120,000 lbs. only)	8.05c
Butler Co. (50,000 lbs. only)	8.28c

Antique Book

No. 22—500,000 lbs., 25x38—100 and 120 flat, cut 33x43, 38x48 and 38x50 ins.

Mudge Paper Co.	7.40c
R. P. Andrews Paper Co.	7.26c
Paper Corp. of U. S.	7.18c

Lightweight Machine-Finish Book

No. 23—40,000 lbs., 25x38—60; flat, cut 32x48 and 38x48 ins.

Graham Paper Co.	9.18c

50 Per Cent Rag Lightweight Machine-Finish Book

No. 24—40,000 lbs., 25x38—60; flat, cut 32x48— and 38x48 ins. Min. order 10,000 lbs.

Old Dominion Paper Co.	17.47c

50 Per Cent Rag Antique Book

No. 26—200,000 lbs., 25x38—80; flat, cut 32x48 and 38x48 ins.

Whitaker Paper Co.	12.41c
Mudge Paper Co.	13.72c
Old Dominion Paper Co.	13.45c
Stanford Paper Co. (60,000 lbs. only)	14.78c

No. 27—80,000 lbs., 25x38—80; flat, cut 22¾x31½, 29x41 and 31½x45½ ins.

Whitaker Paper Co.	12.41c
Mudge Paper Co.	13.72c
Old Dominion Paper Co.	13.45c
Stanford Paper Co. (24,000 lbs. only)	15.28c

No. 28—100,000 lbs., 25x38—90; flat, cut any size, min. width 24 ins., max. width 42 ins.

Whitaker Paper Co.	12.41c
Mudge Paper Co.	13.72c
Old Dominion Paper Co.	13.45c
Stanford Paper Co.	14.25c

75 Per Cent Rag Laid Antique Book

No. 29—20,000 lbs., 25x38—140; flat, cut 24x38 and 29x41 ins.; the laid marks to run the 24-inch and 29-inch direction of the sheet; the grain and chain marks to run lengthwise of the sheet.

Whitaker Paper Co.	18.60c
Stanford Paper Co.	23.10c
Barton, Duer & Koch Paper Co.	13.95c
Paper Corp. of U. S.	17.55c

100 Per Cent Rag Antique Book

No. 31—30,000 lbs., 25x38—90; flat, cut 24x38 and 38x48 ins.; the grain to run lengthwise of the sheet. Min. order 5,000 lbs.

Willcox, Walter Furloy Paper Co.	23.00c
Barton, Duer & Koch Paper Co.	20.00c
Paper Corp. of U. S.	21.31c

No. 32—10,000 lbs., 25x38—140; flat, cut 24x38 and 38x48 ins.; the grain to run lengthwise of the sheet. Min. order 10,000 lbs.

Whitaker Paper Co.	28.60c
Willcox, Walter, Furloy Paper Co.	23.00c
Barton, Duer & Koch Paper Co.	18.00c
Paper Corp. of U. S.	21.31c

Supercalendered Book

No. 34—2,500,000 lbs., 25x38—90; flat, cut 31¼x45½, 32x48, 34x44, 38x48 and 39x50 ins.

Frank Parsons Paper Co.	6.75c

No. 35—1,000,000 lbs., 25x38—100; flat cut 38x48 ins.

R. P. Andrews Paper Co.	7.30c

No. 36—1,000,000 lbs., 25x38—90; rolls, 28½ and 38 ins. wide (3-inch fiber cores).

Marquette Paper Co.	6.40c

No. 37—1,000,000 lbs., 25x38—100; rolls, 28½ and 38 ins. wide (3-inch fiber cores).

Perkins-Goodwin Co.	6.85c
R. P. Andrews Paper Co.	6.80c

No. 38—1,000,000 lbs., 25x38—100; rolls, 28½ and 38 ins. wide (3-inch fiber cores).

Perkins-Goodwin Co.	6.85c
R. P. Andrews Paper Co.	6.80c
Marquette Paper Co. (200,000 lbs. only)	7.30c

Machine-Coated Book

No. 39—2,000,000 lbs. 25x38—100 and 120; flat, cut 35x45, 38x48, 38x50, and 38x51 ins.

Mead Sales Co. (400,000 lbs. only)	7.272c

Coated Book

No. 41—2,500,000 lbs., 25x38—140 and 160; flat, cut 24x32, 24x38, 29x41, 34x44, 38x48, 38x50 and 39x51 ins.; the grain to run lengthwise of the sheet.

Whitaker Paper Co. (100,000 lbs. only)	8.85c
Bradner, Smith & Co. (100,000 lbs. only)	8.98c
Old Dominion Paper Co. (100,000 lbs. only)	8.977c
John F. Post, Inc. (200,000 lbs. only)	9.12c
Perkins-Goodwin Co. (500,000 lbs. only in equal monthly shipments)	8.95c
Stanford Paper Co.	8.93c
Paper Corp. of U. S. (60,000 lbs. only)	8.88c
Marquette Paper Co. (300,000 lbs. only)	9.40c
Butler Co. (110,000 lbs. only)	8.88c

50 Per Cent Rag Coated Book

No. 42—30,000 lbs., 25x38—140 and 160; flat, cut 32x42 and 38x48 ins.; the grain to run lengthwise of the sheet.

Dill & Collins, Inc.	14.78c
Chicago Paper Co.	14.96c
Mudge Paper Co.	17.75c

50 Per Cent Rag Machine-Finish Lithograph

No. 43—60,000 lbs., 25x38—160; flat, cut 10½x16 ins., the grain to run lengthwise of the sheet.

Whitaker Paper Co.	12.68c
Old Dominion Paper Co.	13.77c
Paper Corp. of U. S.	13.97c

Mimeograph, White and Colored

No. 44—600,000 lbs., white, Nos. 40; and 48; flat, cut 24½x30½, 24½x32, 24½x38; 26x42½, and 28½x34½ ins.; the grain to run lengthwise of the sheet.

Whitaker Paper Co.	6.94c
Eastern Corp.	7.28c

No. 45—600,000 lbs., white, Nos. 40 and 48; rolls, 32½ and 34½ ins. wide (3-inch fiber cores).

Eastern Corp.	7.03c
Barton, Duer & Koch Paper Co.	6.92c
North West Paper Co.	7.03c

No. 46—250,000 lbs., blue, buff, green, pink and yellow, No. 40; flat, cut 24½x30½, 24½x32, 24½x38, and 26x42½ ins.; the grain to run lengthwise of the sheet. Min. order, one color, 10,000 lbs.

Cauthorne Paper Co., Inc.	8.20c

25 Per Cent Rag Mimeograph

No. 48—3,500,000 lbs., Nos. 40 and 48; flat, cut 24½x30½, 24½x38, 26x42½, 28½x34½, and 32½x42½ ins.; the grain to run lengthwise of the sheet.

Cauthorne Paper Co., Inc. (200,000 lbs. only)	11.00c
Old Dominion Paper Co. (1,000,000 lbs. plus 10%)	9.995c
Aetna Paper Co.	10.12c

No. 49—1,000,000 lbs., Nos. 40 and 48; rolls, 32½ and 34½ ins. wide (3-inch fiber cores).

Bradner, Smith & Co. (40,000 lbs. only)	10.02c
Old Dominion Paper Co. (300,000 lbs. only)	9.64c
Graham Paper Co. (40,000 lbs. Nos. 40 and 48, only)	10.02c
Butler Co. (40,000 lbs. Nos. 40 and 48 only)	10.12c

Blue U S M O Safety Writing

No. 51—500,000 lbs., No. 32; rolls, 22 ins. wide, 24 ins. in diameter (3-inch fiber cores).

R. P. Andrews Paper Co.	11.98c

U S M O Writing, White and Blue

No. 52—5,000 lbs., No. 32; rolls, 8½ inches wide, 24 ins. in diameter (3-inch fiber cores). Min. order, either color, 4,000 lbs.

R. P. Andrews Paper Co. (white—min. order 5000 lbs.)	11.50c
(blue—min. order 5000 lbs.)	12.00c

Safety Writing Colored

No. 53—4,000 lbs., blue, gray, green, pink salmon, and yellow, No. 40; flat, cut 17x28, 21x32, and 22x34 ins. Min. order, one color, 2,000 lbs.

Whitaker Paper Co.	13.55c
R. P. Andrews Paper Co.	15.00c
Paper Corp. of U. S.	14.00c

Sulphite Writing, White and Colored

No. 54—200,000 lbs., white, No. 26; flat, cut 32x42 ins.

Eastern Corp.	8.95c

No. 55—4,500,000 lbs., white, No. 32; flat, cut any size, min. width 21 ins., max, width 34 ins.

Whitaker Paper Co. (900,000 lbs. only)	6.90c
R. P. Andrews Paper Co. (500,000 lbs. only)	7.27c
Eastern Corp.	7.28c
Marquette Paper Co. (250,000 lbs. only)	9.18c

No. 56—8,000,000 lbs., white, Nos. 40 and 48; flat, cut any size, min. width 21 ins., max. width 41 ins.

Mudge Paper Co.	7.50c
Perkins-Goodwin Co. (1,800,000 lbs. only)	7.25c
R. P. Andrews Paper Co. (750,000 lbs. only)	7.27c
Eastern Corp.	7.28c
Barton, Duer & Koch Paper Co. (700,000 lbs. only)	7.22c
Marquette Paper Co. (250,000 lbs. only)	8.23c
(250,000 lbs. only)	8.48c

No. 57—250,000 lbs., white, No. 26; rolls, min. width 16 ins., max. width 38 ins. (3-inch fiber cores).

Cauthorne Paper Co. (max. quantity 420,000 lbs. on lots 57, 58, 59, 102, 103, on any one or all)	8.00c
Northwest Paper Co.	8.65c
Butler Co.	7.97c

No. 58—1,500,000 lbs., white, No. 32; rolls, min. width 16 ins., max. width 48 ins. (3-inch fiber cores).

Cauthorne Paper Co. (max. quantity 420,000 lbs. on lots 57, 58, 59, 102, 103 on any one or all)	7.25c
Mudge Paper Co.	7.25c
Marquette Paper Co. (250,000 lbs. only)	8.15c
(250,000 lbs. only)	8.23c

No. 59—250,000 lbs., white, Nos. 40 and 48; rolls, min. width 16 ins., max. width 48 ins. (3-inch fiber cores).

Cauthorne Paper Co. (max. quantity 420,000 lbs. on lots 57, 58, 59, 102, 103 on any one or all)	7.25c
Eastern Corp.	7.03c
Barton, Duer & Koch Paper Co.	6.97c
Northwest Paper Co.	7.03c

No. 60—250,000 lbs., blue, buff, cherry, green, pink, salmon and yellow, No. 26; flat, cut any size, min. width 21 ins., max. width 38 ins. Min. order, one color, 5,000 lbs.

No. bids.

No. 61—1,500,000 lbs., blue, buff, cherry, green, pink, salmon and yellow Nos. 32 and 40; flat, cut any size, min. width 21 ins., max. width 34 ins. Min. order, one color, 10,000 lbs.

Marquette Paper Co. (250,000 lbs. only)	9.25c

No. 62—1,500,000 lbs., blue, buff, cherry, green, pink, salmon and yellow, No. 26; rolls, 32, 34 and 38 ins. (3-inch fiber cores).

Marquette Paper Co. (200,000 lbs. only)	9.25c

No. 63—400,000 lbs., blue, buff, cherry, green, pink, salmon and yellow, Nos. 32 and 40; rolls 32, 34, and 38 ins. (3-inch fiber cores).

Mead Sales Co. (140,000 lbs. only)	7.76c
Stanford Paper Co.	9.34c

Lithograph-Finish Map

No. 64—100,000 lbs. Nos. 32 and 40 flat, cut any size. Min. width 22 ins.

maximum width 48 ins.

R. P. Andrews Paper Co..... 8.97c

50 Per Cent Rag Lithograph-Finish Map

No. 65—800,000 lbs., Nos. 32, 40, 48 and 56; flat, cut any size, min. width 22 ins., max. width, 48 ins., the grain to run lengthwise of the sheet.

R. P. Andrews Paper Co.....
(40,000 lbs. No. 48 and 40 only) 14.11c
Graham Paper Co.....
(50,000 lbs. only) 15.32c
Stanford Paper Co. .....
(150,000 lbs. only) 15.56c

75 Per Cent Rag Lithograph-Finish Map

No. 66—600,000 lbs., Nos. 32 and 40; flat, cut any size, min. width 24 ins., max. width 48 ins.; the grain to run lengthwise of the sheet.

Mudge Paper Co.....
(190,000 lbs. only) 17.86c
Graham Paper Co.....
(50,000 lbs. only) 20.42c

No. 67—60,000 lbs., Nos. 48 and 56; flat, cut any size, min. width 30 ins., max. width 48 ins.; the grain to run lengthwise of the sheet. Min. order, one substance, 5,000 lbs.

Walker-Goulard Plehn, Inc..... 21.96c
Mudge Paper Co.....
(25,000 lbs.) 17.86c

100 Per Cent Rag White Chart, Lithographed-Finish

No. 69—800,000 lbs., Nos. 83 and 96; flat, cut any size, min. width 22 ins., max. width 46 ins.; packed in cases of 1,000 sheets each; the grain to run lengthwise of the sheet unless otherwise specified.

Graham Paper Co.....
(50,000 lbs. only) 26.04c
Barton, Duer & Koch Paper Co..
(120,000 lbs. only) 23.70c
Paper Corp. of U. S.....
(240,000 lbs. only) 21.12c

Sulphite Manifold, White and Colored

No. 70—300,000 lbs., white, No. 18; flat, cut 21x32, 22x34, and 28x34 ins.; the grain to run the 21-inch way on the 21x32-inch size.

Import Paper Co. .....
(80,000 lbs. only) 13.75c
R. P. Andrews Paper Co..... 9.80c
Graham Paper Co..... 9.65c
Paper Corp. of U. S.....
(100,000 lbs. only) 11.00c
Marquette Paper Co..... 11.00c

No. 71—100,000 lbs. white, No. 18; rolls, 24 ins. wide. (3-inch fiber cores).

Import Paper Co.....
(80,000 lbs. only) 13.25c
R. P. Andrews Paper Co..... 9.55c
Marquette Paper Co..... 10.00c

No. 72—100,000 lbs., blue, buff, green, pink, salmon and yellow, No. 18; flat, cut 21x32, 22x34, and 28x34 ins.; the grain to run the 21-inch way on the 21x32-inch size. Min. order, one color, 5,000 lbs.

Import Paper Co.....
(20,000 lbs. only) 14.75c
Paper Corp. of U. S.....
(70,000 lbs. only) 12.00c

No. 73—50,000 lbs. blue, buff, green, pink, salmon, and yellow, No. 18; rolls, 24 ins. wide. (3-inch fiber cores).

Import Paper Co.....
(20,000 lbs. only) 14.25c

50 Per Cent Rag Manifold, White and Colored

No. 75—150,000 lbs., white, No. 14; flat, cut 21x32, 22x34, 28x34 and 38x48 ins.; the grain to run the 21-inch way on the 21x32-inch size. Min. order, 5,000 lbs.

R. P. Andrews Paper Co.....
(50,000 lbs. only) 21.95c
Marquette Paper Co.....
(90,000 lbs. only) 19.50c

No. 76—1,000,000 lbs., white, No. 18; flat, cut 21x32, 22x34, 24x38 and 28x34 ins.; the grain to run the 21-inch way on the 21x32-inch size.

Walker-Goulard Plehn, Inc. 21.50c
Chicago Paper Co.....
(100,000 lbs. only) 19.30c
Old Dominion Paper Co.....
(40,000 lbs. only) 25.979c
Stanford Paper Co.....
(120,000 lbs. only) 17.75c
Barton, Duer & Koch Paper Co...
(100,000 lbs. only) 21.00c
Paper Corp. of U. S.....
(120,000 lbs. only) 21.82c
Butler Co. .....
(150,000 lbs. only) 19.81c

No. 77—200,000 lbs., white, No. 18; rolls, 24 ins. wide. (3-inch fiber cores).

Walker-Goulard Plehn, Inc. 20.00c
Barton, Duer & Koch Paper Co... 19.25c
Paper Corp. of U. S.....
(120,000 lbs. only) 20.15c

No. 78—50,000 lbs., blue, buff, cherry, green, pink, salmon and yellow, No. 14; flat, cut 21x32, 22x34, and 28x34 ins.; the grain to run the 21-inch way on the 21x32-inch size. Min. order, one color, 3,000 lbs.

Marquette Paper Co.....
(30,000 lbs. only) 22.00c

No. 79—300,000 lbs., blue, buff, cherry, green, pink, salmon and yellow, No. 18; flat, cut 21x32, 22x34, 24x38 and 28x34 ins.; the grain to run the 21-inch way on the 21x32-inch size. Min. order, one color, 5,000 lbs.

Walker-Goulard Plehn, Inc. 18.89c
Barton, Duer & Koch Paper Co...
(120,000 lbs. only) 22.00c

No. 80—100,000 lbs., blue, buff, cherry, green, pink, salmon, and yellow. No. 18; rolls, 24 ins. wide. (3-inch fiber cores).

No bids.

100 Per Cent Rag White Manifold

No. 83—15,000 lbs., No. 14; flat, cut 17x28, 19x24, 21x32, and 22x34 ins.; the grain to run the 21-inch way on the 21x32-inch size. Min. order, 5,000 lbs.

R. P. Andrews Paper Co..... 38.00c

No. 84—40,000 lbs., No. 18; flat, cut 17x28, 19x24, 21x32 and 22x34 ins.; the grain to run the 21-inch way on the 21x32 ins. size. Min. order 5,000 lbs.

Whitaker Paper Co.....
(10,000 lbs. only) 39.00c
Old Dominion Paper Co..... 27.448c
R. P. Andrews Paper Co..... 34.90c

50 Per Cent Rag White Glazed Manifold

No. 85—300,000 lbs., No. 16; flat cut 19x24 and 21x32 ins.; the grain to run the 21-inch way on the 21x32-inch size. Min. order 20,000 lbs.

R. P. Andrews Paper Co.....
(90,000 lbs. only) 28.00c
Barton, Duer & Koch Paper Co...
(120,000 lbs. only) 19.75c

Sulphite White Bond

No. 102—1,000,000 lbs., No. 40; flat, cut any size, min. width 21 ins.; max. width 37 ins.

Cauthorne Paper Co..... 7.50c
R. P. Andrews Paper Co.....
(340,000 lbs. only) 7.51c
Eastern Corp. 7.28c
Marquette Paper Co.....
(200,000 lbs. only) 8.47c

No. 103—500,000 lbs. No. 40; rolls, 32 ins. wide. (3-inch fiber cores).

Whitaker Paper Co..... 7.25c
Cauthorne Paper Co..... 7.25c
Eastern Corp. 7.03c

25 Per Cent Rag Bond, White and Colored

No. 105—400,000 lbs., white, No. 26; flat, cut any size, min. width 21 ins.; max. width 34 ins.

Walker-Goulard Plehn, Inc. 17.18c
Aetna Paper Co.....
(75,000 lbs. only) 15.20c

No. 106—1,000,000 lbs., white, No. 32; flat, cut any size, min. width 21 ins., max. width 34 ins.

Walker-Goulard Plehn, Inc..... 13.92c
Bradner Smith & Co...(80,000 lbs. only selected from lots 106, 107, 111, and 112)..... 12.72c
Baxter Paper Co..(50,000 lbs. only) 13.55c
Virginia Paper Co..... 12.72c
Aetna Paper Co.....
(100,000 lbs. only) 12.44c

No. 107—2,500,000 lbs., white, No. 40; flat, cut any size, min. width 21 ins., max. width 34 ins.

Walker-Goulard Plehn, Inc..... 13.90c
Bradner Smith & Co...(80,000 lbs. selected from lots 106, 107, 112). 12.72c
R. P. Andrews Paper Co.....
(80,000 lbs. only) 11.92c
Aetna Paper Co.....
(400,000 lbs. only) 12.22c
Butler Co. .....
(600,000 lbs. only) 12.68c

No. 108—2,500,000 lbs., white, No. 40; flat, cut any size, min. width 21 ins., max. width 48 ins.

Aetna Paper Co.....
(400,000 lbs. only) 12.23c
Butler Co. .....
(600,000 lbs. only) 12.68c

No. 109—1,200,000 lbs., white, No. 48; flat, cut any size, min. width 21 ins., max. width 34 ins.

Whitaker Paper Co.....
(100,000 lbs. only) 13.47c
Aetna Paper Co.....
(100,000 lbs. only) 12.21c

No. 110—100,000 lbs. white, No. 26; rolls, 32 and 34 ins. wide. (3-inch fiber cores).

No bids.

No. 111—200,000 lbs. white, No. 32; rolls, 24, 34, and 40 ins. wide. (3-inch fiber cores).

Bradner Smith & Co...(80,000 lbs. only, from lots, 106, 107, 112, 111) 12.20c
Virginia Paper Co..... 12.20c

No. 112—1,000,000 lbs. white, No. 40; rolls, 34, 40, and 48 ins. wide. (3-inch fiber cores).

Bradner Smith & Co...(80,000 lbs. only from lots 106, 107, 112, 111) 12.20c
Aetna Paper Co.....
(100,000 lbs. only) 12.19c

No. 113—250,000 lbs., blue, buff, cherry, green, pink, salmon and yellow, No. 26; flat, cut any size, min. width 21 ins., max. width 34 ins. Min. order, one color, 5,000 lbs.

No bids.

No. 114—700,000 lbs., blue, buff, cherry, green, pink, salmon and yellow, No. 32; flat, cut any size, min. width 21 ins., max. width 34 ins.

R. P. Andrews Paper Co.....
(80,000 lbs. only) 14.28c
Barton, Duer & Koch Paper Co... 14.61c
Aetna Paper Co.....
(100,000 lbs. only) 12.97c

No. 115—1,200,000 lbs., blue, buff, cherry, green, pink, salmon and yellow No. 40; flat, cut any size, min. width 21 ins., max. width 34 ins.

Old Dominion Paper Co.....
(50,000 lbs. maximum) 14.20c

R. P. Andrews Paper Co.....
(80,000 lbs. only) 12.42c
Barton, Duer & Koch Paper Co... 14.59c
Aetna Paper Co.....
(100,000 lbs. only) 12.75c

No. 116—100,000 lbs.; blue, buff, cherry, green, pink, salmon, and yellow, No. 48; flat, cut any size, min. width 21 ins., max. width 34 ins.

Barton, Duer & Koch Paper Co... 14.55c
Aetna Paper Co..... 12.78c

No. 117—50,000 lbs., blue, buff, cherry, green, pink, salmon, and yellow, No. 26; rolls, 32 ins. wide. (3-inch fiber cores).

No bids.

No. 118—100,000 lbs., blue, buff, cherry, green, pink, salmon, and yellow, No. 32; rolls, 32 ins. wide. (3-inch fiber cores).

No bids.

50 Per Cent Rag Bond, White and Colored

No. 120—200,000 lbs., white, No. 26; flat, cut any size, min. width 21 ins., max. width 34 ins.

No bids.

No. 121—1,500,000 lbs., white, Nos. 32 and 40; flat, cut any size, min. width 21 ins., max. width 34 ins.

Mudge Paper Co.....
(1 carload only, 40,000 lbs.) 15.94c
Virginia Paper Co..... 14.85c
R. P. Andrews Paper Co.....
(500,000 lbs. only) 15.27c
Graham Paper Co.....
(300,000 lbs. only of No. 40) 14.49c
Barton, Duer & Koch Paper Co...
(100,000 lbs. only) 15.40c
Aetna Paper Co.....
(400,000 lbs. only) 13.94c

No. 122—700,000 lbs., white, No. 48; flat, cut any size, min. width 21 ins., max. width 34 ins.

Mudge Paper Co.....
(1 carload only 40,000 lbs.) 15.91c
R. P. Andrews Paper Co.....
(200,000 lbs. only) 15.40c
Aetna Paper Co.....
(300,000 lbs. only of No. 40) 13.83c

No. 123—500,000 lbs., white, No. 32; rolls, 24 ins. wide. (3-inch fiber cores).

Virginia Paper Co..... 14.40c

No. 124—120,000 lbs., blue, buff, cherry, green, pink, salmon and yellow, No. 40; flat, cut any size, min. width 21 ins., max. width 34 ins. Min. order, one color, one substance, 2,500 lbs.

Mudge Paper Co.....
(1 carload only—36,000 lbs.) 16.62c

75 Per Cent Rag White Bond

No. 125—2,500 lbs., No. 26; flat, cut any size, min. width 21 ins., max. width 32 ins. Min. order, 2,000 lbs.

R. P. Andrews Paper Co..... 23.40c
Paper Corp. of U. S..... 21.50c

No. 126—2,500 lbs., Nos. 32, 40, and 48; flat, cut any size, min. width 21 ins., max. width 32 ins. Min. order, one substance, 2,000 lbs.

Old Dominion Paper Co..... 20.24c
R. P. Andrews Paper Co..... 20.43c
Paper Corp. of U. S..... 19.27c

100 Per Cent Rag White Bond

No. 128—50,000 lbs., Nos. 32 and 40; flat, cut any size, min. width 16 ins., max. width 32 ins. Min. order, one substance, 2,000 lbs.

Old Dominon Paper Co..... 25.238c
26.978c
R. P. Andrews Paper Co..... 25.13c
Barton, Duer & Koch Paper Co... 24.75c
Paper Corp. of U. S..... 24.29c

No. 129—25,000 lbs., No. 48; flat, cut any size, min. width 16 ins., max. width 32 ins. Min. order, 2,000 lbs.

Walker-Goulard Plehn, Inc..... 26.73c
Old Dominion Paper Co..... 25.238c
R. P. Andrews Paper Co..... 27.31c
Barton, Duer & Koch Paper Co... 24.75c
Paper Corp. of U. S..... 24.29c

100 Per Cent Rag Declaration Bond

No. 140—15,000 lbs., Nos. 32 and 40; flat, cut 17x22, 22x25½, and 25½x33 ins. Min. order, one substance, 3,000 lbs.

Whitaker Paper Co..... 39.50c
Walker-Goulard Plehn. Inc..... 39.50c
Old Dominion Paper Co..... 28.98c
Perkins-Goodwin Co. 40.29c
Graham Paper Co..... 39.50c
Stanford Paper Co..... 26.00c
Barton, Duer & Koch Paper Co... 25.25c

100 Per Cent Rag Parchment Deed

No. 141—6,000 lbs., No. 64; flat, cut 33x34 ins. Min. order, 2,000 lbs.

Walker-Goulard Plehn, Inc. 27.79c
Old Dominion Paper Co..... 27.98c
R. P. Andrews Paper Co..... 25.94c
Stanford Paper Co..... 25.00c
Paper Corp. of U. S..... 23.80c

Sulphite White Ledger

No. 151—400,000 lbs., Nos. 56 and 64; flat, cut any size, min. width 17 ins., max. width 42 ins. Min. order, one substance, 10,000 lbs.

Mudge Paper Co..... 8.40c
Eastern Corp. 8.05c
Marquette Paper Co.....
(200,000 lbs. only) 8.50c

No. 152—600,000 lbs., No. 80; flat, cut any size, min. width 17 ins., max. width 42 ins.

Mudge Paper Co..... 8.35c
Barton, Duer & Koch Paper Co... 8.50c

25 Per Cent Rag Ledger, White and Colored

No. 154—120,000 lbs., white, Nos. 48 and 56; flat, cut 24x38, 28x29, 28x34, and 32x42 ins. Min. order, one substance, 5,000 lbs.

Walker-Goulard Plehn, Inc. 14.84c
Baxter Paper Co.....
(72,000 lbs. only) 14.35c
Mathers-Lamm Paper Co..... 13.50c

No. 155—100,000 lbs., white, No. 64; flat, cut 23x36 and 32x42 ins. Min. order, 5,000 lbs.

Walker-Goulard Plehn, Inc..... 14.84c
Mathers-Lamm Paper Co..... 13.50c

No. 156—50,000 lbs., white, No. 72; flat, cut 24x38, 28x34, and 32x42 ins. Min. order, 5,000 lbs.

Walker-Goulard Plehn, Inc..... 14.84c
Mathers-Lamm Paper Co..... 13.50c

No. 157—50,000 lbs., blue, buff, green, pink, salmon and yellow, Nos. 56, 64, and 72; flat, cut 23x36, 24x38, 26x36, and 28x34, and 32x42 ins. Min. order, one substance, one color, 3,000 lbs.

No bids.

50 Per Cent Rag Ledger, White and Colored

No. 160—300,000 lbs., white, Nos. 48 and 56; flat, cut 18½x36, 18½x40¼, 24x38, 28x29, 28x34, 29x41, and 32x42 ins. Min. order, one substance, 10,000 lbs.

Mudge Paper Co.....
(75,000 lbs. only) 15.66c
Baxter Paper Co..... 16.15c
Barton, Duer & Koch Paper Co... 16.92c

No. 161—120,000 lbs., white, No. 64; flat, cut 23x36 and 32x42 ins. Min. order, 10,000 lbs.

Walker-Goulard Plehn, Inc..... 16.88c
Mudge Paper Co.....
(30,000 lbs. only) 15.66c
Barton, Duer & Koch Paper Co... 16.88c
Mathers-Lamm Paper Co..... 15.68c
Frank Parsons Paper Co..... 16.50c

No. 162—400,000 lbs., white, Nos. 72 and 80; flat, cut 24x38, 28x34, 32x42 and 38x48 ins. Min. order, 10,000 lbs.

Walker-Goulard Plehn, Inc.....
(75,000 lbs. only) 16.84c
(80,000 lbs. only) 16.70c
Mudge Paper Co..... 15.66c
(100,000 lbs. only) 15.66c
Mathers-Lamm Paper Co..... 15.68c
Frank Parsons Paper Co..... 16.50c

No. 163—200,000 lbs., white, No. 88; flat, cut 32½x42 ins. Min. order, 10,000 lbs.

Walker-Goulard Plehn, Inc. 16.88c
Mudge Paper Co.....
(75,000 lbs. only) 15.66c

No. 164—250,000 lbs., blue, buff, cherry, green, pink, salmon and yellow, Nos. 56, 64, and 72; flat, cut 18½x36, 18½x40¼, 19x24, 23x36, 28x34 and 32x42 ins. Min. order, one substance, one color, 5,000 lbs.

Eastern Corp. 17.58c

No. 165—200,000 lbs. blue, buff, cherry, fawn, green, pink, salmon and yellow. No. 88; flat, cut 32½x42 ins. Min. order, one color, 5,000 lbs.

No bids.

75 Per Cent Rag Ledger, White and Colored

No. 168—40,000 lbs., white, Nos. 48 and 56; flat, cut 21x32, 24x38, 28x29, and 28x34 ins. Min. order, one substance, 4,000 lbs.

Walker-Goulard Plehn, Inc..... 21.24c
Mudge Paper Co.....
(15,000 lbs. only) 19.96c
R. P. Andrews Paper Co..... 21.89c
Barton, Duer & Koch Paper Co... 18.00c
Frank Parsons Paper Co..... 20.50c

No. 169—60,000 lbs., white, No. 64; flat, cut 21x32, 23x36, 24x38, and 28x34 ins. Min. order, 5,000 lbs.

Walker-Goulard Plehn, Inc..... 21.24c
Mudge Paper Co.....
(25,000 lbs. only) 19.96c
R. P. Andrews Paper Co..... 21.89c
Barton, Duer & Koch Paper Co... 18.00c
Frank Parsons Paper Co..... 20.50c

No. 170—80,000 lbs., white, Nos. 72 and 80; flat, cut 20x28, 21x32, 24x38, and 28x34 ins. Min. order, one substance, 5,000 lbs.

Walker-Goulard Plehn, Inc..... 21.24c
Mudge Paper Co.....
(30,000 lbs. only) 19.96c
R. P. Andrews Paper Co..... 21.68c
Frank Parsons Paper Co..... 20.50c

No. 171—50,000 lbs., white, No. 88; flat, cut 21x32½ ins. Min. order, 5,000 lbs.

Walker-Goulard Plehn, Inc..... 21.24c
Mudge Paper Co.....
(20,000 lbs. only) 19.98c
R. P. Andrews Paper Co..... 21.68c
Frank Parsons Paper Co..... 20.50c

No. 172—30,000 lbs., blue, buff, cherry, green, pink, salmon and yellow, Nos. 56, 64, and 72; flat, cut 21x32, 23x36, 24x38, and 28x34 ins. Min. order, one substance, one color, 3,000 lbs.

No bids.

No. 173—20,000 lbs., blue, buff, cherry, fawn, green, pink, salmon and yellow, No. 88; flat, cut 21x32½ ins. Min. order, one color, 4,000 lbs.

No bids.

100 Per Cent Rag White Ledger

No. 176—80,000 lbs., No. 48; flat, cut 21x32, 22¾x31½, 23x36, 24x38, and 28x34 ins. Min. order, 4,000 lbs.

Whitaker Paper Co.....
(4,000 lbs. only) 35.00c
Walker-Goulard Plehn, Inc. 26.89c
Old Dominion Paper Co..... 28.978c

Perkins-Goodwin Co. 35.70c
R. P. Andrews Paper Co..... 25.64c
Graham Paper Co.....
(4,000 lbs. only) 35.00c
Stanford Paper Co.....
(4,000 lbs. only) 35.00c
Barton, Duer & Koch Paper Co...
(4,000 lbs. only) 35.00c
Paper Corp. of U. S..... 22.05c

No. 177—50,000 lbs., No. 56; flat, cut 20x28, 21x32, 23x36, 24x38, and 28x34 ins. Min. order 5,000 lbs.

Whitaker Paper Co.....
(5,000 lbs. only) 35.00c
Walker-Goulard Plehn, Inc..... 26.89c
Old Dominion Paper Co..... 28.978c
(15,000 lbs. only) 27.978c
Perkins-Goodwin Co.....
(5,000 lbs. only) 35.70c
Graham Paper Co.....
(5,000 lbs. only) 35.00c
Stanford Paper Co.....
(5,000 lbs. only) 35.00c
Barton, Duer & Koch Paper Co...
(5,000 lbs. only) 35.00c
Paper Corp. of U. S..... 22.05c

No. 178—15,000 lbs., No. 64; flat, cut 18½x42, 21x32, 23x36, and 28x34 ins. Min. order, 5,000 lbs.

Walker-Goulard Plehn, Inc..... 26.89c
R. P. Andrews Paper Co..... 25.83c
Paper Corp. of U. S..... 22.05c

No. 179—40,000 lbs., No. 72; flat, cut 20x28, 21x32, 24x38, and 28x34 ins. Min. order, 5,000 lbs.

Whitaker Paper Co..... 35.00c
Walker-Goulard Plehn, Inc..... 26.89c
Old Dominion Paper Co..... 35.09c
Perkins-Goodwin Co. 35.70c
R. P. Andrews Paper Co..... 25.83c
Graham Paper Co..... 35.00c
Stanford Paper Co..... 35.00c
Barton, Duer & Koch Paper Co... 35.00c
Paper Corp. of U. S..... 22.05c

No. 180—10,000 lbs., No. 80; flat, cut 21x32½ and 21x42 ins. Min. order,, 4,000 lbs.

Whitaker Paper Co..... 35.00c
Walker-Goulard Plehn, Inc..... 26.89c
Old Dominion Paper Co..... 35.09c
Perkins-Goodwin Co. 35.70c
R. P. Andrews Paper Co..... 25.70c
Graham Paper Co..... 35.00c
Stanford Paper Co..... 35.00c
Barton, Duer & Koch Paper Co... 35.00c
Paper Corp. of U. S..... 22.05c

No. 181—40,000 lbs., No. 88; flat, cut 20½x24¾, 21x32½ and 22¾x31½ ins. Min. order, 5,000 lbs.

Whitaker Paper Co.....
(5,000 lbs. only) 35.00c
Walker-Goulard Plehn, Inc..... 26.89c
Old Dominion Paper Co.....
(5,000 lbs. only) 35.09c
Perkins-Goodwin Co.....
(5,000 lbs. only) 35.70c
R. P. Andrews Paper Co..... 25.70c
Graham Paper Co.....
(5,000 lbs. only) 35.00c
Stanford Paper Co.....
(5,000 lbs. only) 35.00c
Barton, Duer & Koch Paper Co..
(5,000 lbs. only) 35.00c
Paper Corp. of U. S..... 22.05c

Sulphite White Index

No. 184—800,000 lbs., 22½x28½—182 and 230; flat, cut 24½x32½, 32½x42, and 32½x48½ ins., with projecting colored-paper marker between each 100 sheets. Min. order, one weight, 10,000 lbs.

Mudge Paper Co. (100,000 lbs. only) 8.20c
(100,000 lbs. only) 8.00c
R. P. Andrews Paper Co.....
(100,000 lbs. only) 8.15c

50 Per Cent Rag Index, White and Colored

No. 190—800,000 lbs., white, 22½x28½—182 and 230; flat, cut 24½x32½ and 32½x42 ins., with projecting colored-paper marker between each 100 sheets. Min. order, one weight, 10,000 lbs.

Walker-Goulard Plehn, Inc..... 16.36c
Barton, Duer & Koch Paper Co...
(150,000 lbs. only) 16.16c
Aetna Paper Co. (100,000 lbs. only) 13.76c
Mathers-Lamm Paper Co..... 15.25c
Frank Parsons Paper Co..... 16.50c

No. 191—40,000 lbs., white, 22½x28½—280 and 362; flat, cut 32½x42 ins., with projecting colored-paper marker between each 100 sheets. Min. order, one weight, 5,000 lbs.

Walker-Goulard Plehn, Inc..... 16.50c

No. 192—500,000 lbs., blue, buff, fawn, green, pink, salmon and yellow, 22½x28½—182 and 230; flat, cut 32½x42 ins., with projecting colored-paper marker between each 100 sheets. Min. order, one color, one weight, 5,000 lbs.

Walker-Goulard Plehn, Inc..... 17.08c

No. 193—100,000 lbs., blue, buff, fawn, green, pink, salmon and yellow, 22½x28½—280 and 362; flat, cut 32½x42 ins., with projecting colored-paper marker between each 100 sheets. Min. order, one color, one weight, 5,000 lbs.

Walker-Goulard Plehn, Inc..... 17.22c

100 Per Cent Rag White Index

No. 196—180,000 lbs., 22½x28½—approximately 206; flat, cut 20½x30½ and 32½x42 ins.

Whitaker Paper Co.....
(10,000 lbs. only) 34.50c
Walker-Goulard Plehn, Inc..... 25.89c
Old Dominion Paper Co.....
(10,000 lbs. only) 34.58c
Perkins-Goodwin Co. .....
(10,000 lbs. only) 35.19c
R. P. Andrews Paper Co.....
(80,000 lbs. only) 26.05c
Graham Paper Co. (10,000 lbs. only) 34.50c
Stanford Paper Co.....
(10,000 lbs. only) 34.50c
Barton, Duer & Koch Paper Co..
(60,000 lbs. only) 23.50c
Frank Parsons Paper Co..... 25.50c

White Tissue

No. 197—4,000 lbs., flat, 21x32—18. Min. order 1,000 lbs.

Mathers-Lamm Paper Co..... 14.93c

Coated Cover, White and Colored

No. 201—100,000 lbs., white, 20x26—130 and 160; flat, 26½x41 ins., the grain to run lengthwise of the sheet. Min. order, 5,000 lbs.

Whitaker Paper Co..... 9.75c
Dill & Collins, Inc..... 9.92c

No. 202—80,000 lbs., India tint, light green, and emerald green, 20x26—100; flat, 26½x41 ins. Min. order, 5,000 lbs.

Dill & Collins, Inc.....(India) 10.27c
(Green) 10.77c

Machine-Finish Cover, White and Colored

No. 203—600,000 lbs., antique; white, dawn, quaker drab, robin's egg, terra cotta, light blue, dark blue, buff, gold, cream, light gray, dark gray, light brown, dark brown, light green, dark green, sage, gobelin blue, and coral red; flat, 19½x25¼—95, with projecting colored-paper marker between each 500 sheets. Min. order, one color 5,000 lbs.

Bradner Smith & Co..... 9.58c
R. P. Andrews Paper Co.....
(total awards on 203 and 204 not to exceed 200,000 lbs.)..... 9.74c
Graham Paper Co. (50,000 lbs. only) 10.95c
Stanford Paper Co..... 10.50c
Marquette Paper Co..... 8.98c
Butler Co. .....(50,000 lbs. only) 10.175c

No. 204—200,000 lbs., smooth; white, blue, brown, granite, green, pink, tea and yellow, 20x26—100; flat, cut 19½x25¼ and 33x46 ins., with projecting colored-paper marker between each 500 sheets. Min. order, one color, 5,000 lbs.

Bradner Smith & Co..... 9.58c
R. P. Andrews Paper Co.....
(total awards on 203 and 204 not to exceed 200,000 lbs.)..... 9.74c
Graham Paper Co. .....
(50,000 lbs. only) 10.95c
Stanford Paper Co. .....
(50,000 lbs. only) 10.175c
(balance of lot) 10.25c
Marquette Paper Co..... 8.98c

50 Per Cent Rag Laid Cover, Colored

No. 205—80,000 lbs., blue, cream, white, gray and green, 20x26—130; flat, cut 19½x25¼, 22x33, 26½x41, and 28x41 ins., in wrapped bundles with projecting colored-paper marker between each 500 sheets. Min. order, one color, 2,000 lbs.

Whitaker Paper Co..... 17.30c
Walker-Goulard Plehn, Inc..... 12.45c
Old Dominion Paper Co..... 14.47c
R. P. Andrews Paper Co..... 14.47c
Barton, Duer & Koch Paper Co... 13.50c

Wood Manila

No. 209—200,000 lbs., 24x36—80 to 120; flat, cut 21x32, 22½x34½, 25x38 and 32x36 ins., in wrapped bundles with projecting colored-paper marker between each 500 sheets.

Old Dominion Paper Co..... 5.747c

No. 210—300,000 lbs., 24x36—80 to 120; rolls, 18, 21, 32 and 48 ins. wide (3-inch fiber cores).

Stanford Paper Co..... 5.50c
Paper Corp. of U. S..... 4.92c
Frank Parsons Paper Co..... 5.221c

Chemical Wood Manila

No. 211—40,000 lbs., 24x36—100 to 160; flat, cut any size in wrapped bundles. Min. order, one weight, 5,000 lbs.

R. P. Andrews Paper Co..... 7.65c
Paper Corp. of U. S..... 7.49c

No. 212—20,000 lbs., 24x36—100 to 160; rolls, 32 ins. wide (3-inch fiber cores).

R. P. Andrews Paper Co..... 7.40c
Paper Corp. of U. S..... 7.24c

Rope Manila

No. 213—10,000 lbs., 24x36—120, 140 and 160; rolls, 18 and 48 ins. wide (3-inch fiber cores). Min. order, 5,000 lbs.

R. P. Andrews Paper Co..... 22.50c

No. 214—40,000 lbs. 24x36—280; rolls, 48 ins. wide (3-inch fiber cores). Min. order, 5,000 lbs.

R. P. Andrews Paper Co..... 21.00c

Drumhead Manila

No. 215—40,000 lbs., 24x36—280; flat, cut 20x30 and 26x42 ins. Min. order, 5,000 lbs.

Mudge Paper Co..... 23.40c

No. 2 Kraft

No. 217—600,000 lbs., 24x36—83 to 166, flat, cut any size in wrapped bundles.

No bids.

No. 218—400,000 lbs., 24x36—83 to 166; cut any size, folded (25 sheets per fold), in wrapped bundles.

No bids.

No. 219—1,000,000 lbs., 24x36—83 to 166; rolls, 9, 10½, 11½, 24, 36, 39, and 48 ins. wide, wound on wooden plugs, 1½-inch hole, or on 3-inch fiber cores as may be specified.

No bids.

No. 1 Kraft

No. 220—15,000 lbs., 24x36—125 and 166; flat, cut any size in wrapped bundles.

Paper Corp. of U. S..... 8.10c

White Paraffin

No. 251—4,000 lbs., flat, 24x38—32. Min. order, 1,000 lbs.

Cauthorne Paper Co., Inc.	12.75c

White Gummed

No. 252—600,000 sheets, flat, 22x34 ins. Min. order, 25,000 sheets.

	Dollars per M sheets
Whitaker Paper Co...(per M sheets)	$15.28
Brander Smith & Co.	14.96
Mudge Paper Co. (100,000 sheets only)	15.75
Eureka Specialty Printing Co.	13.32
Virginia Paper Co.	16.50
R. P. Andrews Paper Co.	16.69
Graham Paper Co.	15.28
Stanford Paper Co.	15.60
Barton, Duer & Koch Paper Co.	15.60
Paper Corp. of U. S.	15.20

Blotting, White and Colored

No. 254—20,000 lbs., white, flat, 19x24—160, in wrapped bundles. Min. order, 4,000 lbs.

Whitaker Paper Co.	7.97c
Bradner Smith & Co.	7.33c
Cauthorne Paper Co.	7.50c
Mudge Paper Co.	7.50c
Old Dominion Paper Co.	7.489c
Garrett Buchanan Co.	7.37c
Virginia Paper Co.	7.50c
Graham Paper Co.	7.38c
Stanford Paper Co.	7.37c
Barton, Duer & Koch Paper Co.	7.50c
Mathers-Lamm Paper Co.	7.50c
Butler Co.	7.44c

No. 255—2,000 lbs., buff and salmon, flat, 19x24—160, in wrapped bundles. Min. order, 2,000 lbs.

Whitaker Paper Co.	8.97c
Bradner Smith & Co.	8.54c
Cauthorne Paper Co., Inc.	8.50c
Mudge Paper Co.	8.50c
Old Dominion Paper Co.	8.89c
Garrett Buchanan Co.	8.59c
Virginia Paper Co.	8.50c
Graham Paper Co.	8.59c
Stanford Paper Co.	8.59c
Barton, Duer & Koch Paper Co.	8.50c
Mathers-Lamm Paper Co.	8.50c
Butler Co.	8.67c

25 Per Cent Rag Blotting, White and Colored

No. 256—50,000 lbs., white, flat, 19x24—160, in wrapped bundles. Min. order, 10,000 lbs.

Whitaker Paper Co.	8.66c
Bradner Smith & Co.	8.25c
Cauthorne Paper Co., Inc.	9.15c
Mudge Paper Co.	9.15c
Old Dominion Paper Co.	9.143c
Garrett Buchanan Co.	8.30c
Virginia Paper Co.	8.85c
Graham Paper Co.	8.30c
Stanford Paper Co.	8.30c
Barton, Duer & Koch Paper Co.	8.85c
Mathers-Lamm Paper Co.	9.05c
Butler Co.	8.30c

No. 257—40,000 lbs., buff and salmon, flat, 19x24—160, in wrapped bundles. Min. order, one color, 2,000 lbs.

Whitaker Paper Co.	9.16c
Bradner Smith & Co.	8.51c
Cauthorne Paper Co., Inc.	9.60c
Mudge Paper Co.	9.60c
Old Dominion Paper Co.	9.594c
Garrett Buchanan Co.	8.56c
Virginia Paper Co.	9.60c
Graham Paper Co.	8.55c
Stanford Paper Co.	8.56c
Barton, Duer & Koch Paper Co.	9.60c
Mathers-Lamm Paper Co.	9.498c
Butler Co.	8.56c

Desk Blotting, Colored

No. 258—5,000 lbs., blue and buff flat, 19x24—200, in wrapped bundles. Min. order, one color, 5,000 lbs.

Whitaker Paper Co.	7.97c
Bradner Smith & Co.	8.90c
Cauthorne Paper Co., Inc.	7.40c
Mudge Paper Co.	7.40c
Old Dominion Paper Co.	7.49c
Garrett Buchanan Co.	8.95c
Virginia Paper Co.	7.40c
Graham Paper Co.	8.95c
Stanford Paper Co.	8.95c
Barton, Duer & Koch Paper Co.	7.40c
Mathers-Lamm Paper Co.	7.32c
Butler Co.	9.00c

No. 259—200,000 lbs. moss-green, flat, 19x24—200, in wrapped bundles. Min. order, 10,000 lbs.

Whitaker Paper Co.	6.68c
Bradner Smith & Co.	7.36c
Cauthorne Paper Co., Inc.	7.20c
Mudge Paper Co.	7.20c
Old Dominion Paper Co.	7.189c
Garrett Buchanan Co.	7.40c
Virginia Paper Co.	7.20c
R. P. Andrews Paper Co.	6.67c
Graham Paper Co.	7.35c
Stanford Paper Co.	7.40c
Barton, Duer & Koch Paper Co.	7.20c
Mathers-Lamm Paper Co.	7.088c
Butler Co.	7.38c

Oiled Manila Tympan

No. 262—60,000 lbs., 24x36—approximately 210; rolls, 38 and 48 ins. wide; 10-inch diameter; wound on wooden plugs, 1½-inch hole. Min. order, 5,000 lbs.

Link Paper Co.	13.50c
Cromwell Paper Co.	11.50c
R. P. Andrews Paper Co.	8.85c

Plate-Wiping, for Embossing Presses

No. 263—10,000 lbs., 24x36—100; rolls, 24 ins. wide (3-inch fiber cores) Min. order, 1,000 lbs.

Barton, Duer & Koch Paper Co.	8.50c

Back-Lining for Case-Making Machines

No. 264—6,000 lbs., 24x36—180; rolls, 24 ins. diameter, 37 ins. wide (3-inch fiber cores). Min. order, 2,000 lbs.

Barton, Duer & Koch Paper Co.	4.64c

High-Finish Red Sulphite

No. 265—20,000 lbs., flat, 24x36—320 and 400, in wrapped bundles. Min. order, 5,000 lbs.

Mudge Paper Co.	8.25c

High-Finish Sulphite Manila Tag

No. 271—180,000 lbs., 24x36—160 to 280; flat, cut any size, min. width 24 ins., max. width 38 ins., in wrapped bundles.

R. P. Andrews Paper Co.	7.25c

Calendered Tag, Manila and Colored

No. 276—1,000,000 lbs., manila, 22½x28½—150; rolls, 23¼ and 26½ ins. wide (6-inch iron cores).

Barton, Duer & Koch Paper Co.	8.25c

No. 277—200,000 lbs., blue, brown, green, ivory, pink, red, salmon and yellow, 22½x28½—150; rolls 23¼ and 26½ ins. wide (6-inch iron cores). Min. order, one color, 10,000 lbs.

Barton, Duer & Koch Paper Co.	9.25c

Jute Tag

No. 280—250,000 lbs., 22½x28½—200 and 280; flat cut 28x38 ins., in wrapped bundles. Min. order, one weight, 10,000 lbs.

Mudge Paper Co.	11.25c

Manila Board

No. 281—80,000 lbs., 22½x28½—400; flat, cut 17x28, 21x32, and 22½x28½ ins., in wrapped bundles with projecting colored-paper marker between each 100 sheets. Min. order, 10,000 lbs.

Paper Corp. of U. S.	5.50c

Railroad Board, White and Colored

No. 302—100,000 sheets, white, flat, 22x28 ins., 4-ply, each 100 sheets fully banded, packed in wooden cases. Min. order, 10,000 sheets.

Bradner Smith & Co. per M sheets.	$28.05
(on skids)	27.21
Old Dominion Paper Co.	28.298
(on skids)	27.474
R. P. Andrews Paper Co.	28.27
Virginia Paper Co.	28.34
Stanford Paper Co.	28.35
(on skids)	27.50
Barton, Duer & Koch Paper Co.	28.35
Paper Corp. of U. S.	28.34

No. 303—400,000 sheets, white, flat, 22x28 ins., 8-ply, each 100 sheets fully banded, packed in wooden cases. Min. order, 5,000 sheets.

Bradner Smith & Co. per M sheets.	$40.31
(on skids)	39.08
Old Dominion Paper Co.	40.69
(on skids)	39.438
Virginia Paper Co. Per M sheets	42.92
R. P. Andrews Paper Co.	40.67
Stanford Paper Co.	40.75
(on skids)	39.50
Barton, Duer & Koch Paper Co.	40.75
Paper Corp. of U. S.	42.92

No. 304—60,000 sheets, white, flat, 22x28 ins., 14-ply, each 50 sheets fully banded, packed in wooden cases. Min. order, 5,000 sheets.

Bradner Smith & Co. per M sheets.	$56.05
(on skids)	54.33
Old Dominion Paper Co.	56.57
(on skids)	54.838
Virginia Paper Co.	63.05
R. P. Andrews Paper Co.	56.57
Stanford Paper Co.	56.65
(on skids)	54.90
Barton, Duer & Koch Paper Co.	56.60
Paper Corp. of U. S.	63.05

No. 305—200,000 sheets, ash gray, blue, buff, green, lemon and orange, flat 22x28 ins., 4-ply, each 100 sheets fully banded, packed in wooden cases. Min. order, one color, 5,000 sheets.

Bradner Smith & Co. per M sheets.	$35.12
(on skids)	34.02
Old Dominion Paper Co.	35.449
(on skids)	34.349
Virginia Paper Co.	37.34
R. P. Andrews Paper Co.	35.47
Stanford Paper Co.	35.50
(on skids)	34.41
Barton, Duer & Koch Paper Co.	35.50
Paper Corp. of U. S.	37.34

Wood Bristol, Colored

No. 306—300,000 lbs., buff 22½x28½—150; rolls, 20 and 22 ins. wide (6-inch iron cores).

Mudge Paper Co. (el lots)	5.66c

No. 307—300,000 lbs., blue, buff, gray, green, melon, pink, quaker-drab and yellow, flat, 20x30—187; in wrapped bundles with projecting colored-paper marker between each 100 sheets.

No bids.

No. 308—250,000 lbs., blue, brown, buff, gray, green, melon, pink and yellow, 22½x28½—200; rolls, 20 in. wide (6-in. iron cores).

Old Dominion Paper Co.	5.497c
Frank Parsons Paper Co.	5.471c

No. 309—250,000 lbs., blue, brown, buff, gray, green, melon, pink and yellow, 22½x28½—200; rolls, 20 ins. wide (6-inch iron cores).

Old Dominion Paper Co.	5.497c
Frank Parsons Paper Co.	5.471c

No. 310—40,000 lbs., buff, 22½x28½—200; flat, cut 12x18 and 14½x17½ ins., the grain to run lengthwise of the sheet, in wrapped bundles with projecting colored-paper marker between each 100 sheets.

No bids.

Pulp and Paper Making Machinery

Over a long period of years, our company has specialized in the making of equipment for the Pulp and Paper Industry.

Since 1930 the complete line has been redesigned and enlarged to fill the most exacting specifications of modern mills.

IMPCO Products now consist of:

—CONTINUOUS ROTARY VACUUM WASHERS for:

1—**Black liquor** (brown stock) **counter-current washing**; Rubber covered, cast iron and stainless, cast iron and Monel vacuum washers for chlorinated, causticized and hypochlorite treated bleached pulps;

2—**Vacuum Savealls**

3—**Vacuum sheet-forming machines** as wet ends for new and existing wet machines or pulp drying machines;

4—**Sludge filters** for sulphate lime sludge, precipitated chalk, and sludges in the chemical industries;

5—**Special purpose vacuum washers and thickeners** for cotton linters for washing gun cotton, washers for flax pulp for cigarette paper, and other specialized fibers;

6—**Auxiliary equipment** including shredders, re-pulpers, mixers, stock volume-metering devices, Bellmer Agitators, etc.

—FLAT SCREENS—IMPCO low type with Dunbar (patented) drive having either:

1—**Cypress vats with oak cross-members** for screw fastened plates or with Witham Fasteners for beveled plates;

2—**Cypress vat screens with bronze cross-members** and IMPCO Fasteners for bevelled plates.

3—**All-Bronze vat screens;**

—OPEN CYLINDER MACHINES with vats of wood, all cast iron, or cast iron and steel. These may be either unlined or lined with stainless, Monel, Everdur, copper, rubber, etc., including:

1—**Deckers,** single or double end, couch roll drives optional;

2—**Multiple stage washers,** two, three, four or five stage

—KNOTTERS with pulley or integral worm drives;

—CENTRIFUGAL SCREENS for ground wood, kraft, sulphite, soda or special pulps;

—WET MACHINES of normal or high density, high capacity types;

—BLEACHING EQUIPMENT

—PNEUMATIC MACHINES for use as raw water filters, thickeners or savealls;

—TRAVELLING SHOWERS with hydraulically operated oscillating nozzles which replace conventional drilled or flat spray showers;

—OPEN CYLINDER MOULDS of brass, bronze, iron or stainless steel construction;

—MIDGET FILTERS, flat screens, deckers, etc., for laboratories or pilot plants;

—SPECIAL MACHINERY

Improved Paper Machinery Corporation

Nashua • New Hampshire

United States Postal Card Bristol

No. 325—2,500,000 lbs., 22½x28½—188; rolls, 33 ins. wide and 36 ins. in diameter (6-inch iron cores).

Whitaker Paper Co..... 6.23c
R. P. Andrews Paper Co.....
(600,000 lbs. only) 6.17c

No. 326—2,500,000 lbs., 22½x28½—188; rolls, 33 ins. wide and 36 ins. in diameter (6-inch iron cores).

Whitaker Paper Co..... 6.20c
R. P. Andrews Paper Co.....
(60,000 lbs. only) 6.17c

No. 327—2,500,000 lbs., 22½x28½—188; rolls, 33 ins. wide and 36 ins. in diameter (6-inch iron cores).

R. P. Andrews Paper Co.....
(60,000 lbs. only) 6.17c
Barton, Duer & Koch Paper Co.... 6.98c

Pressboard, Colored

No. 351—30,000 sheets, red, flat, 24x32 ins., thickness .0140 inch. Min. order, 5,000 sheets.

Whitaker Paper Co.....
per C sheets (5,000 sheets only) $9.35
Walker-Goulard Plehn, Inc..... 9.17
Barton, Duer & Koch Paper Co.... 7.75

No. 352—30,000 sheets, gray, flat, 30x36 ins., thickness .0300 inch. Min. order, 5,000 sheets.

Whitaker Paper Co.....
per C sheets (12,000 sheets only) $25.15
Walker-Goulard Plehn, Inc..... 26.03
Barton, Duer & Koch Paper Co.... 18.85

News Board

No. 360—1,000,000 lbs., 26x38 ins., No. 100, flat, cut any size, min. 21x32 ins., max. 40x52½ ins. (to be trimmed square on four sides).

Import Paper Co..... 2.50c

Chip Board

No. 361—1,000,000 lbs., 26x38 ins., No. 50, flat; cut any size, min. 21x32 ins., max. 40x52½ ins.

Import Paper Co..... 2.25c

Marble Grained Lined Board

No. 362—25,000 lbs., 26x38 ins., No. 50; flat, cut 22x32 ins.

Old Dminion Paper Co..... 4.939c
Mathers-Lamm Paper Co..... 5.17c

Strawboard

No. 363—15,000 lbs., flat, 26x38 ins., No. 50.
No bids.

Lined Chip Board

No. 364—10,000 lbs., flat, 26x38 ins., No. 50.
No bids.

Lined Box Board

No. 365—60,000 lbs., 26x38 ins., No. 40; flat, cut 24½x34 ins. Min. order, 36,000 lbs.
No bids.

Binder's Board, No. 1 Quality

No. 366—800,000 lbs., flat, to trim 25x30 ins., Nos. 16, 18, 20, 25, 30 and 40.

Consolidated Paper Co..... 4.425c
R. P. Andrews Paper Co..... 4.14c
Mathers-Lamm Paper Co..... 4.08c

No. 367—150,000 lbs., 24¾x30¾ ins., Nos. 12 and 20; flat, to trim 34x44 ins.

Consolidated Paper Co..... 4.425c
R. P. Andrews Paper Co..... 4.14c

Binder's Board, Best Quality

No. 368—200,000 lbs., flat, to trim 20x30 ins., and 22x38 ins., Nos. 18, 20, 25, 30, 35, 40 and 45. Min. order, 5,000 lbs.

Consolidated Paper Co..... 5.40c
R. P. Andrews Paper Co..... 5.639c

Badger Erects New Warehouse

The expansion program of the Badger Paper Mills, Peshtigo, Wis., during the year includes the erection of a new finishing and warehouse building, 215 feet long and 130 feet wide.

The structure is of two-story, steel and brick construction. The first floor is used entirely for the routing of finished stock, preparatory to loading it into cars for shipment.

Stock not yet packed for shipment is stored and identified in individual shelf bins on the first floor. This arrangement saves considerable time in filling orders from the stock shelves.

The second floor is used exclusively for operating and processing stock. There is no paper on the floor in this department which is not necessary for immediate finishing.

Equipment installed in the new building consists of three rotary cutters, three flat trimmers, and one automatic safety trimmer for small sizes.

The building is equipped with a freight elevator for finished stock and a second freight elevator is used for handling paper broke returned to the beaters.

M. B. Houston Made Vice President

Rayonier Inc. announces the appointment of Morton B. Houston as a vice president to fill the position left vacant by the recent death of W. L. Raymond.

Mr. Houston has been associated with the Rayonier organization for eleven years, having entered the company's service as purchasing agent and subsequently serving for a number of years as assistant to Mr. Raymond.

Prior to his association with Rayonier, Mr. Houston had been identified with the pulp and paper industry in various capacities since 1912. Thus he brings to his new position an extensive background of experience and an intimate knowledge of the duties which he is assuming. Mr. Houston's headquarters will be in Seattle.

Helps Maintain Paper Mill Equipment

With most paper mills running at peak capacity, mill maintenance men are faced with an increasingly acute problem. Machines run longer. Equipment wears more rapidly. Yet long delays may be anticipated in obtaining replacements. Shutdowns may be necessary, especially if parts are made with stainless steel, monel, and other metals now under priority control.

Many other vital industries are finding a successful solution to this problem with metallizing. For instance, worn spindles, packing glands, pump pistons, and rolls are being quickly restored to service with sprayed coatings of the necessary corrosion- and wear-resistant metals. Worn journals and bearing surfaces of numerous types and sizes are likewise rapidly built-up to original dimensions with metallizing.

In most instances it has been reported that the metallized equipment wears longer than the original, although the material and labor for metallizing entail but a fraction of the cost of replacements.

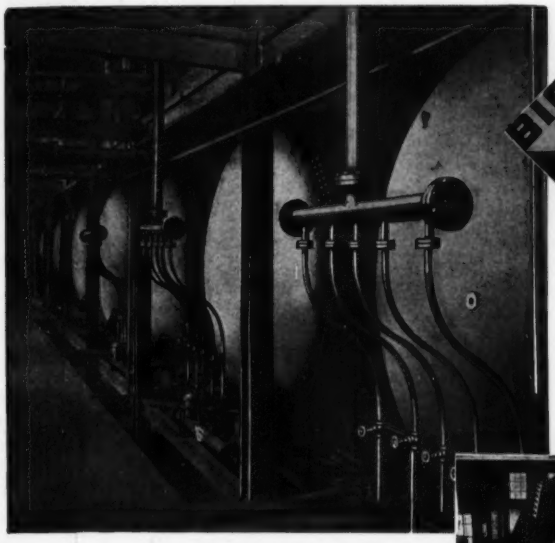
A booklet describing the metallizing process may be obtained from Metallizing Engineering Company, Inc., Long Island City, N. Y. Entitled "How to Get Along with Less Priority Metal", it gives many interesting examples of the time, money, and metal saved by metallizing.

W. A. Hanway Made Secretary

William A. Hanway has been elected secretary of International Paper Company succeeding Coulter D. Young who died last month. Mr. Hanway has been with International Paper Company since 1929.

Great Northern Pays Extra

The Great Northern Paper Company has paid an extra dividend of 50 cents and the regular quarterly of 50 cents. Dividends authorized this year total $2.50, the same as in 1940.



Nine 14' x 40' Horizontal Biggs Digesters

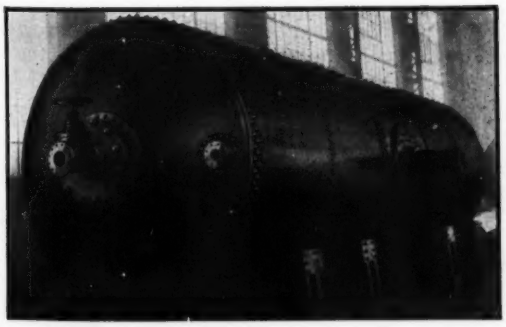
Biggs Welded Rotary Digesters

Left—Installation of nine 14' x 40' Horizontal Digesters at the plant of the Consolidated Water Power and Paper Company, Appleton, Wisc. These Digesters have been giving satisfactory service for many years.

Left—BIGGS All welded Rotary Digesters for Chestnut chip and similar processes. Units may be lined with Monel or similar metals, tile, etc.

18' Dia. Riveted Rotary Digesters

Biggs Standard 8' x 24' Cylinder Rotary Bleaching Boilers



Rotary Tumbling Digesters.

Biggs Digesters

Since 1887 BIGGS have been serving the Paper Industry throughout the world.

BIGGS Globe, Cylinder and Stationary Digesters are furnished in all sizes and are complete with various types of drives, linings, etc., to meet operating conditions encountered.

The established record of BIGGS all-welded Digesters and pressure vessels — a record of 100% performance — is conclusive evidence of BIGGS continued leadership in the Paper Industry.

BUILT BY BIGGS

Globe Rotary Bleaching Boilers; Sulphate and Sulphite Digesters; Cylinder Rotary Boilers; Penstocks; Electric Welded Steel and Iron Pipe for Water and Mill Supply; Welded High Pressure Vessels; Special Steel and Alloy Plate Work for the Paper Industry.

Competent Erecting Organization

THE BIGGS BOILER WORKS CO. Established 1887 AKRON, OHIO, U. S. A.

M. H. Thomas in His Trophy Room

[FROM OUR REGULAR CORRESPONDENT]

PHILADELPHIA, Pa., November 24, 1941—In a room on the second floor adjoining the office of Morgan H. Thomas, president of Garrett-Buchanan Company, 18 South 6th street, where the walls, floor and furniture are decorated with animal heads, skins and life-size stuffed animals, your correspondent found Mr. Thomas relaxing from his arduous duties. His collection which extends over fifteen years includes twenty-four heads, comprising an elk, oryx, water buck, Scotch ram, musk ox, bear, deer, zebra,

Courtesy Phila. Evening Bulletin

MR. THOMAS SURROUNDED BY HIS TROPHIES

Bengal tiger and hartebeest. There are eighteen skins and several stuffed animals. The black and white pelt spread on the chair to the right of the fireplace is that of a Colobus monkey. Mr. Thomas started his collecting when, on a visit to Mt. Lookout, Colorado, he met Johnny Baker, "Buffalo Bill" Cody's adopted son, and was presented with a buffalo head. So fascinated was he that he bought several more heads the next year. On visiting Ireland on one of his fourteen trans-Atlantic crossings, he came back with still another head—and was well launched on a hobby.

Mr. Thomas, born on a farm near Collegeville, was always fond of animals and has a deer farm on his estate, Glenn Knoll at Beth Ayres. He has never hunted or shot an animal himself. Twice yearly all his trophies are visited by their taxidermist for a demothing and general overhauling.

Aerosol Wetting Agents

The characteristics and methods of application of Aerosol wetting agents are discussed in a 78-page booklet issued by the American Cyanamid and Chemical Corporation, 30 Rockefeller Plaza, New York.

The publication discusses types available, solubility, interfacial tension, Draves test, action in acids, action in alkalies and calcium tolerance.

Application of Aerosol in the paper industry are given. These include cleaning paper mill felts, use in decreasing time for wetting out broke, excellent results in the manufacture of blotting paper, treatment of kraft towel stock to retain absorbency and other uses. A bibliography concludes this informative booklet.

Features of Union Bag Program

SAVANNAH, Ga., November 10, 1941—Construction of a new entrance road to the Union Bag and Paper Corporation plant five hundred feet west of the present entrance is included in the $5,000,000 construction program at the plant. T. T. Dunn, engineer in charge of construction, released this and other details of the program in *The Digester.*

Mr. Dunn said the present office site will be torn down in about six months and a new main office building constructed on the new entrance road. Plans to build a new time office, general office, locker room, cafeteria, shop building and supply room in the same general location are also contemplated.

Asked how paper, board and bags will be loaded in freight cars after the proposed construction is completed, Mr. Dunn answered:

"The present loading track in the bag factory will be removed and two new tracks will be installed in the bag factory just east of the present bag factory office. The track will extend approximately 500 feet into the bag factory from the present south wall and loading of bags will be done from both sides. Present tracks east of mill office to be removed and three new tracks installed parallel to and just west of the west wall of the mill office."

When construction is completed, Mr. Dunn estimates, Union Bag will have 2,600 persons on the plant pay roll. There are now 2,200.

Other questions put to the engineer by the editor of the employes' publication were:

"Will pulp mill be enlarged, and how? One 12 x 50 barking drum; one 110-inch 8½ chipper; one new digester; revamp No. 1 diffuser unit; two new 175-ton recovery units; alterations in caustic and evaporator room.

"What will be the length of new board machine, estimated daily tonnage, speed, number of dryers, when will this machine begin operation? Four hundred and fifty feet long; 75 five-foot driers; 20 48-inch driers; production 450 to 550 tons per day; speed 1,600 feet per minute; in operation July, 1942.

"What changes are to be made in bag factory? How much floor space is to be torn out? Are bag machines to be moved? For what purpose? Two floors are planned for the bag factory. New upper floor to comprise about 150,000 square feet. It is planned to lower the first floor 3 feet 6 inches to give head room under the second floor. It is also contemplated that the present west wall of the bag factory will be moved west to coincide with the present west wall of the mill office; with two floors this will provide about 40,000 additional square feet of storage area. Bag machines will be moved to the second floor, which will place them on the same level as the paper machine operating floor.

"Will additional turbine be required for new unit? Yes. A 7,500-K.W. double extraction and condenser unit has been ordered and delivery is expected in June, 1942.

"What will new dock warehouse, just completed, be used for? Storage. There are 60,000 square feet under roof and a 10-foot platform runs to total length of 890 feet on the river side.

"Will this mill be by far the largest paper mill of its kind in the world? This will be the largest 'paper and board' mill in the world. There will be one 'all board' mill larger.

"Will another smokestack be required? We don't know yet."

Pipes, Pumps, Packing, and Valves in the Pulp and Paper Industry

By Vincent F. Waters[1]

The Pulp and Paper Industry

The manufacture of pulp, paper, paperboard and converted paper products comprises one of the largest and most complex process industries in the world. This industry produces about 10,000 kinds of paper and products made from pulp and paper. About 50% of the paper production of the world is produced in the United States and about 60% is consumed by the United States normally.

The progress in engineering, chemistry, and in other fields of science, the efficiency of industry, the spread of education, all depend on the use of paper and paper products. The products of this industry are essential in the everyday lives of every person and every industry in normal times. These products occupy a position of the greatest importance in the present program for National Defense.

The pulp and paper industry, through its contributions to civilized practices and standards and comforts of living, is an essential industry to the nation; and in wartimes, the industry is indispensable to the defense of the United States. Wood pulp is used in substantial amounts for the manufacture of cellulose for nitrating for explosives. Plans for instruments of war are produced on paper, orders are issued on paper, ordnance and quartermaster supplies are wrapped in paper and packed in paperboard boxes. The products of the industry are used for construction of army camps, defense housing, and army and navy aircraft. The forementioned uses of the industry's products for naval and military purposes could be extended to include several thousand normal civilian uses of pulp and paper products.

The primary pulp, paper and paperboard industry employs over 150,000 persons and about the same number in the conversion of paper, and the publishing and printing industry employs about 500,000 persons. In addition, about 500,000 persons in other industries are dependent wholly or in part for their livelihood and include workers in the transportation, forest, petroleum, coal, chemical, farming, and other industries.

The mills require on their staffs men who can deal with mechanical, electrical and chemical engineering problems; others for bacterial, physical, optical, chemical, and other technical and scientific problems. Many company officials are by profession engineers, chemists, etc.

Typical Installations

A typical kraft pulp and paper mill of 300-ton capacity used over 3200 brass valves of the check, globe, gate and cock types (over two-thirds were gate type); over 275 cast steel valves up to 18 inches; over 1300 iron valves up to 24 inches; over 375 forged steel valves; nearly 8000 steel fittings; nearly 40,000 iron fittings; and various miscellaneous material in its construction. The total number of valves required was over 5200. The pipe required consisted of about 190,000 feet of standard steel; 12,000 feet of extra strong; 10,000 galvanized steel; 4500 feet of extra strong seamless steel; 285 feet of spiral welded steel; and other pipe totaling about 220,000 feet. The pipe weighed nearly 700 tons. These materials cost about $300,000 or about $1,000 per ton of capacity. The use of stainless steel, Monel, CNI, and other alloys to a greater extent for this mill would have increased the first cost; but in some cases the increased cost would be justified by obtaining longer life and lower maintenance cost. (*See* Figs. 3 to 8.)

The figures for the kraft mill do not include underground piping, safety railings, and certain other outside piping. An example of the cost of major lines is as follows: steam, $15,000; digester room (four digesters), $24,000; liquor lines, $33,000; boilers, $17,000; drips, $16,000; feedwater lines, $18,000; fuel oil lines, $38,000; machine room (one paper machine), $15,000; causticizing, $12,000. There is no bleach plant included in the kraft mill figures, in other words, the plant manufactures kraft pulp and paper.

The pumps used by the industry include centrifugal, reciprocal, gear and other types made from all kinds of metals and alloys. Capacities as high as 5000 gallons per minute are not unusual. Most of the pumps of the centrifugal type are driven by direct-connected motors. An inventory of one mill of about 40-ton capacity shows a total of 71 pumps installed on actual pulp and paper lines; these pumps have a total capacity of 39,620 gallons per minute or 57,050,800 gallons per day. Twenty-four of these pumps have a capacity of 1000 to 1200 gallons per minute.

The centrifugal pumps required for a typical 300-ton kraft pulp and paper mill number about 150, total cost of pumps, motors, and controls is about $150,000, and the total weight of pumps, motors, and controls is about 250,000 pounds. These figures are considered accurate, because they are based on engineers' estimates for pumping requirements in such a plant.

In the construction of a 500-ton newsprint mill, the cost of the piping plus the installation cost was about $300,000 or a little over $600 per ton of capacity. (*See* Figs. 9 and 10.)

Engineering Materials

The pulp and paper industry is estimated to use about 500,000,000 pounds of metal in a year. About 30,000,000 pounds of copper, brass, and bronze per year are used, of which a considerable portion is for tubular products, pumps and valves. The yearly quantity of alloy steels is estimated to be over 16,000,000 pounds, with a considerable percentage being

[1] Member TAPPI; Technical Assistant to the Secretary, Technical Association of the Pulp and Paper Industry, 122 E. 42nd Street, New York, N. Y.

used for fluid conveying equipment. Over 200,000,000 pounds of iron are estimated to be used yearly, of which about 150,000,000 pounds are for castings. A large quantity of the latter would be used for pumps and valves and parts in addition to large quantities of other metals used for the same purposes.

Among the engineering materials used for pipes, valves, and pumps in the industry are: aluminum, *asbestos-cement,* asphalt coated, *brass, bronze, carbon steel, cast iron, chrome-nickel steel, chromium-steel alloy, copper, copper-molybdenum alloy, copper-nickel alloy,* glass, *lead, lead alloys, galvanized, nickel alloys, nickel-cast iron, nickel-chromium-molybdenum alloys, nickel-chromium steel alloys,* tin, *rubber,* vitrified clay, *wood, wrought iron, laminated plastic.* The materials italicized are widely used in the pulp and paper industry.

Pipe and fittings, made of laminated plastic, are light in weight, tough, corrosion-resistant, and easy to handle but expensive in first cost. The present increase in production capacity due to the war and continued engineering research probably will result in lowering the cost of this extremely useful engineering material.

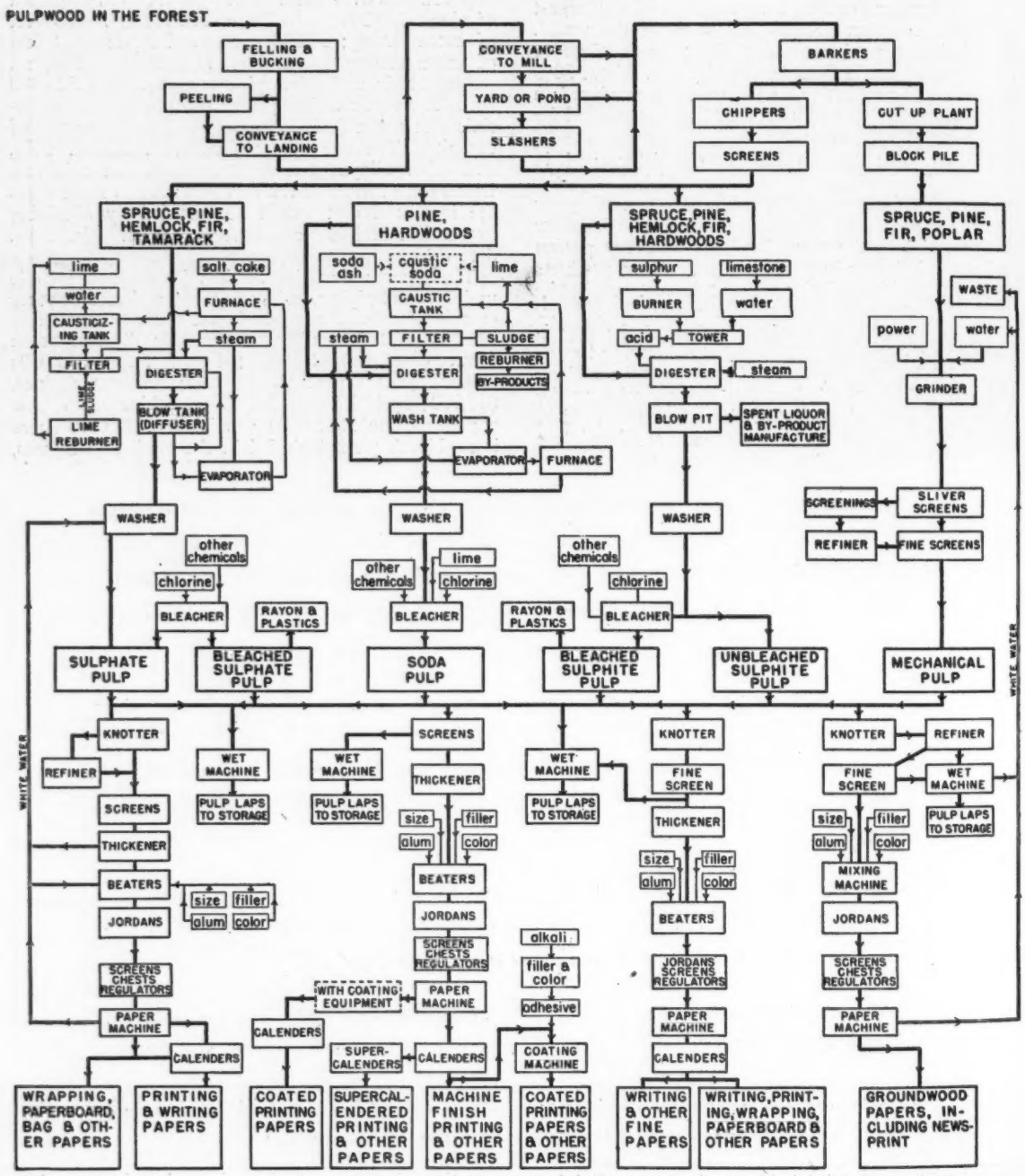
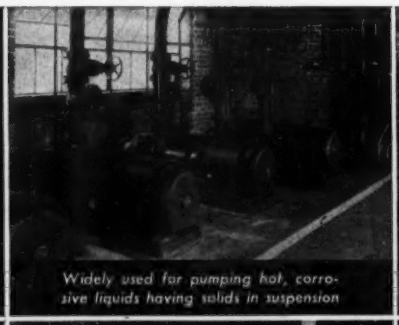


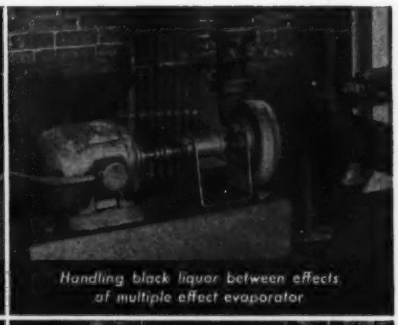
FIG. 1
Flow of Fluids and Materials in Pulp and Paper Processes

WORTHINGTON CENTRIFUGAL CHEMICAL PUMPS for the Paper Industry

Pumping black liquor and salt cake to recovery unit



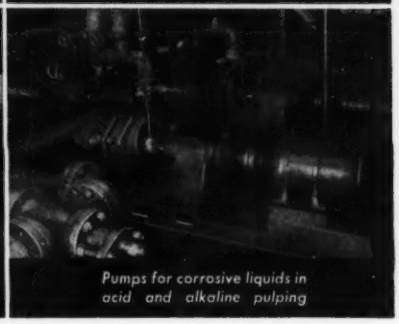
Widely used for pumping hot, corrosive liquids having solids in suspension



Handling black liquor between effects of multiple effect evaporator

Antaciron pumps handling alum . . . suitable for black liquor

Pumping alum . . . original packing after one year's service, 120 hours weekly



Pumps for corrosive liquids in acid and alkaline pulping

Worthington offers a comprehensive line of modern standardized equipment, available in a range of sizes which cover most paper mill pumping jobs . . . constructed of Worthite and other special alloys . . . for handling a wide variety of corrosive materials, both acid and alkali.

These pumps have been developed under a policy of meeting, without compromise, the exacting requirements of the paper industry . . . a policy which long ago recognized the fact that these requirements cannot be met with makeshift adaptations of water pump designs.

Worthington engineers, fully experienced in solving paper mill problems, are prepared to present convincing facts bearing on proposed modernization and plant expansion.

» Write for literature, specifying the classes of service in which you are interested and, consistent with our efforts for defense, which must come first, we will do our utmost to serve you.

WORTHINGTON PUMP AND MACHINERY CORPORATION
GENERAL OFFICES: HARRISON, NEW JERSEY

CP1-6

WORTHINGTON

Corrosion problems have not been discussed; however, the use of protective coatings for the inside of pumps, pipes, etc., as well as the outside is increasing. In this field of protective coatings, chlorinated rubber-base paints probably excite the most interest, but galvanizing, paint, varnish, and lacquers continue to be the most widely used coatings. Engineers must select the coating with the same care and diligence used in the selection of a pump or other equipment.

Courtesy Worthington Pump & Mchy. Corp.

FIG. 3

Two of Nine Worthington Type "CG" Worthite Pumps Handling Black Liquor Between the Effects of a Multiple Effect Evaporator in a Southern Kraft Mill.

Courtesy Worthington Pump & Mchy. Corp.

FIG. 4

Worthington 1¼-CH-2 Black Liquor Pump Handling 60 GPM of Black Liquor and Salt Cake, Against a Total Head of 120 ft. to the Spray Nozzles of a Black Liquor Recovery Unit. The Pump is Driven by 20 HP, 1150 RPM Motor. The Installation is in a Southern Kraft Mill

Glass tubing, fittings, and accessories in sizes from 1 to 4 inches inside diameter for heat exchangers, bleaching systems, handling chlorine, and other services, are being manufactured. One company is developing its manufacturing methods, suitable for the production of glass piping of at least 6 inches inside diameter and possibly 8 inches.

Under the subject of engineering materials, the

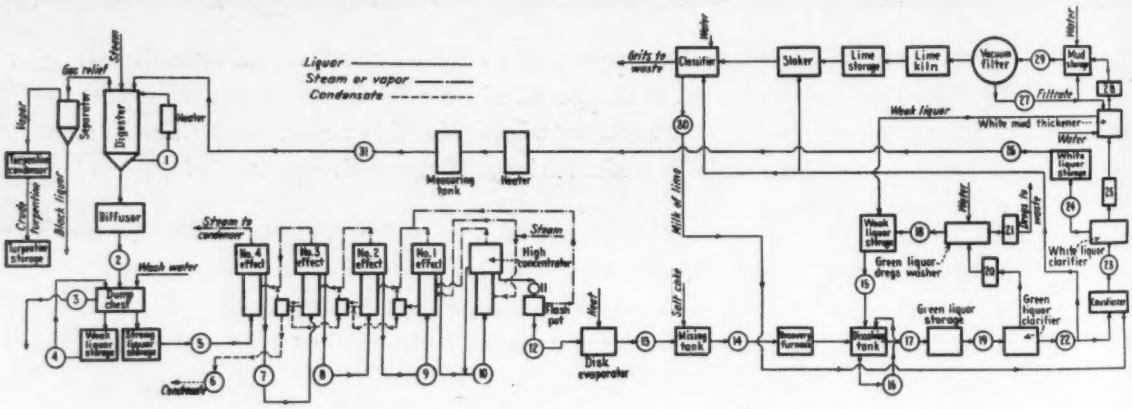


FIG. 2

Typical Fluid Flow in Sulphate Pulping Process

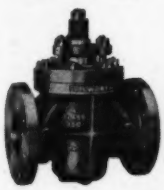
Item	Service	Liquid
1	Digester Circulating	Sulphate Liquor
2	Diffuser to Dump Chest	Brown Stock
3	Washed Stock to Process	Brown Stock
4	Weak Spent Wash Liquor Storage to Dump Chest	Weak Black Liquor
5	Strong Spent Liquor Storage to Evaporator	Strong Black Liquor
6	Steam Condensate from Evaporators	Water Contaminated with Black Liquor
7	Evaporator Effect Transfer	Weak Black Liquor
8	Evaporator Effect Transfer	Intermediate Black Liquor
9	Evaporator Effect Transfer	Concentrated Black Liquor
10	High Concentrator Circulation	Concentrated Black Liquor
11	Concentrated Black Liquor to Flash Pot	Black Liquor
12	Flash Pot to Disk Evaporator	Heavy Black Liquor
13	Disk Evaporator to Mixing Tank	Heavy Black Liquor
14	Recovery Furnace Spray Pump	Black Liquor and Salt Cake
15	Weak Liquor Storage to Dissolving Tank	Weak White and Green Liquor
16	Dissolving Tank Circulating	Raw Green Liquor
17	Dissolving Tank to Green Liquor Storage	Raw Green Liquor
18	Dregs Washer to Weak Liquor Storage	Weak Green Liquor
19	Green Liquor Storage to Clarifier	Raw Green Liquor
20	Dregs from Clarifier to Dregs Washer	Sludge
21	Dregs from Washer to Waste	Sludge
22	Green Liquor Clarifier to Causticizer	Clarified Green Liquor
23	Causticizer to White Liquor	Raw White Liquor
24	White Liquor Clarifier to White Liquor Storage	Clarified White Liquor
25	White Liquor Clarifier to Thickener	Sludge
26	White Liquor Storage to Heater and Measuring Tank	White Liquor
27	Vacuum Filter Filtrate	Weak White Liquor
28	White Mud Thickener to Mud Storage	Sludge
29	Mud Storage to Filter or Waste	Sludge
30	Classifier to Causticizer	Milk of Lime
31	Measuring Tank to Digester	White Liquor

Specify Walworth

FOR POSITIVE CONTROL

Walworth Special Alloy Valves.

Walworth Bronze Valves.



Walworth Lubricated Plug Valves.

Walworth Swing Check Valves.

Cast Chrome-Nickel-Iron Pipe.

Walco Pipe Wrenches.

Positive control means better production in the making of pulp and paper. That's why Walworth's comprehensive line of valves, fittings and pipe are chosen for use in the pulp and paper industry. Walworth products combine to assure trouble-free, positive operation in the most severe services. Years of experience have qualified Walworth to manufacture valves that, once installed, require a minimum of attention and give maximum life. Let Walworth help you maintain positive control surely and economically. The engineers in Walworth's pulp and paper mill division will be glad to assist you in selecting the valves, fittings, or pipe best suited to your particular requirements.

WALWORTH

VALVES FITTINGS and TOOLS

Backed by 93 Years' Service

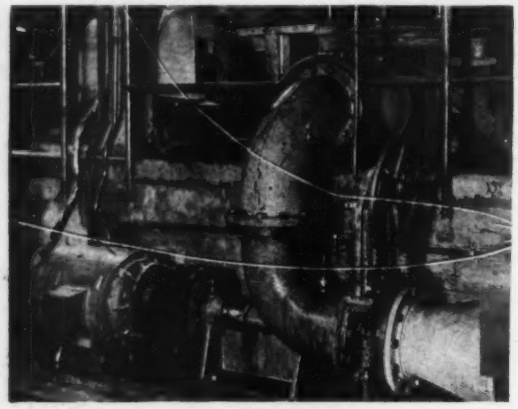
WALWORTH COMPANY 60 EAST 42nd STREET NEW YORK

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

materials used for packing and the types of packing should be mentioned. The packing materials commonly used are asbestos, cotton, metallic, plastic, flax, and rubber; and the types used most extensively are braided, plaited, metal foil, metal plastic, rubber and duck and combinations of the various materials not listed under types.

Packing

The life of packing is dependent on two factors. The first consideration is the selection of the packing material and type of packing. This selection should

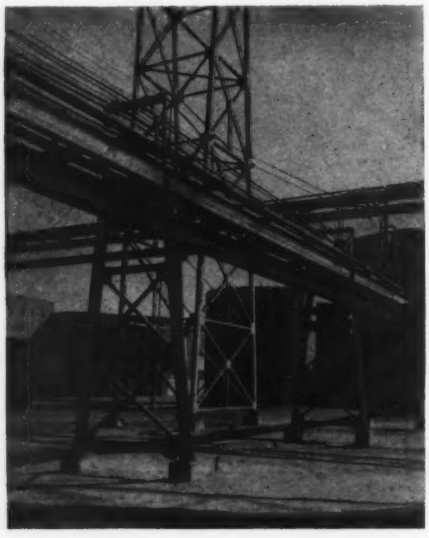


Courtesy Worthington Pump & Mchy. Corp.

FIG. 5

Worthington 10-KE Elbow Type Propeller Pump Handling 2800 GPM, 0.37% Stock against a 6-ft. TDH and Driven by 7½ HP, 1150 RPM Motor. The Pump Is Being Used for Booster Service in a Midwestern Kraft Mill

be based on knowledge of the working conditions under which it must operate — e.g., pressure, temperature, solids and their nature, acidity or alkalinity. After the selection of the packing, the second factor to consider for the maximum life to be obtained is the installation and the mechanical adjustments after



Courtesy Walworth Co.

FIG. 6

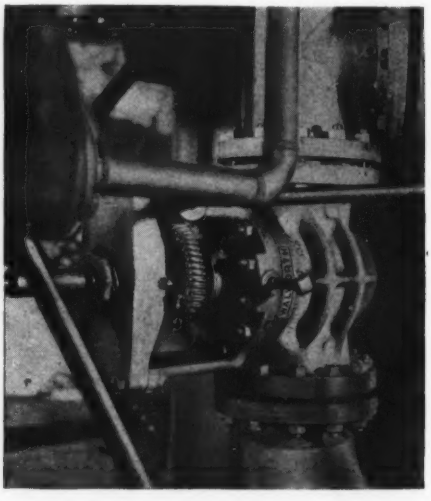
Walworth C.N.I. Pipe on Caustic Liquor Lines in a Southeastern Pulp Mill

Courtesy Walworth Co.

FIG. 7

Walworth No. 725FS Pulp Mill Valves with Extension Stems Installed in a Southern Pulp Mill

installation. As an example of the life of packing on Item 3 (Fig. 2) pumping washed stock to process, one mill obtains 20 days service, three mills obtain 30 days, one mill obtains 90 days, one mill obtains 120 days, and one mill obtains 180 days service. These service records are not unusual but serve to indicate the tremendous importance of packing selection and installation and adjustment; because each mill may have 5, 10, or more of these pumps depending upon the number of digesters or layout, and this service is only one of many pumping services (*see* Figs. 1 and 2). It is not difficult to see that careful



Courtesy Walworth Co.

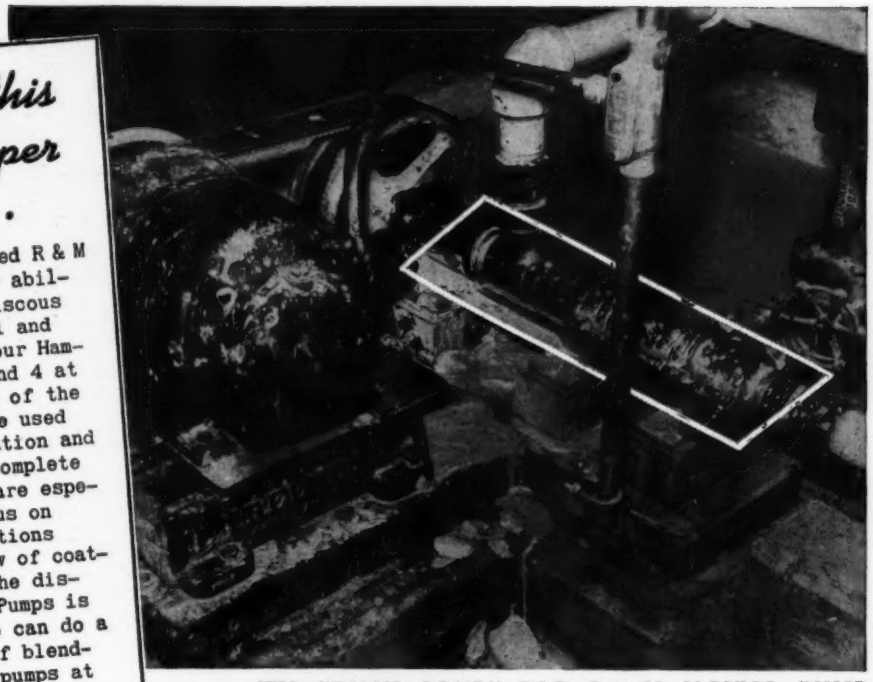
FIG. 8

An 8-Inch Series 300, Ball Bearing, Worm Gear Operated, Walworth Lubricated Plug Valve on Digester Blow-Off Service

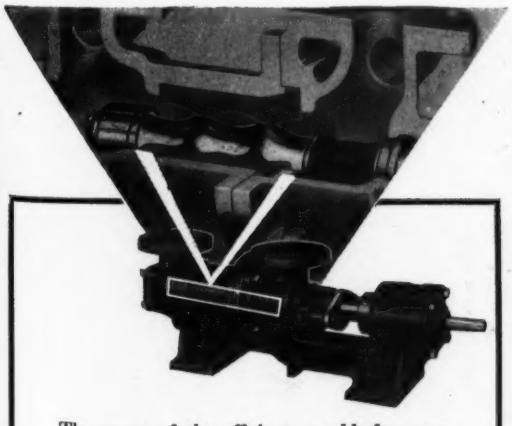
16 R & M MOYNO PUMPS
for Champion Paper & Fibre Company

Read what this Leading Paper Mill says...

"We originally selected R & M Moyno Pumps for their ability to handle very viscous and abrasive material and are now using 12 in our Hamilton, Ohio, plant and 4 at Pasadena, Texas. All of the pumps at Hamilton are used on a coating application and are working to our complete satisfaction. They are especially valuable to us on some of the applications where a metered flow of coating is necessary. The displacement of Moyno Pumps is so positive that we can do a very accurate job of blending by running the pumps at predetermined speeds."



IT'S "DUCK SOUP" FOR R & M MOYNO PUMP
Tough working conditions mean nothing to the R & M Moyno Pump. Here's one of four in the "thick" of production at Champion's Pasadena, Texas, plant.



The secret of the efficient, trouble-free performance of the R & M Moyno Pump is in the pumping action of the helical rotor and stator. Action is like that of a piston moving in one direction through a cylinder of infinite length.

CHAMPION echoes the endorsement given the R & M Moyno Pump by leading paper mills everywhere. The R & M Moyno is the proved and profitable answer to *your* pumping problems.

It resists the wear of heavy, abrasive liquids... handles coating solutions up to 53% solids, delivering a uniform discharge at constant pressure without agitation or cavitation.

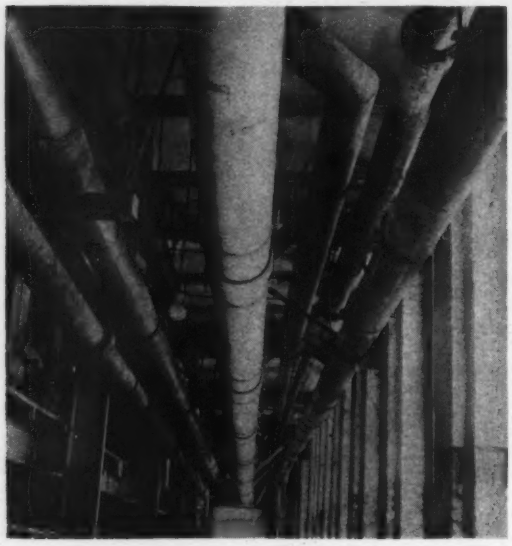
Investigate the R & M Moyno Pump today. There's an R & M field expert at your service, ready to give you the answer to your problems—yes, an answer that may save you thousands of dollars. For further details write today for R & M Moyno Pump Folder No. 1777.

ROBBINS & MYERS, Inc.
MOYNO PUMP DIVISION SPRINGFIELD, OHIO

consideration of the packing problems of the industry would result in increased efficiency of operation and reduce the costs of maintenance.

The conveyance of liquids and gases in the pulp and paper industry requires pumps and valves of every type and design and tremendous quantities of piping and tubing made from all kinds of suitable engineering materials.

In the industrial process industries, pumps, valve, and pipe replacement costs of this industry rank high among the highest. Large quantities of the pipe,

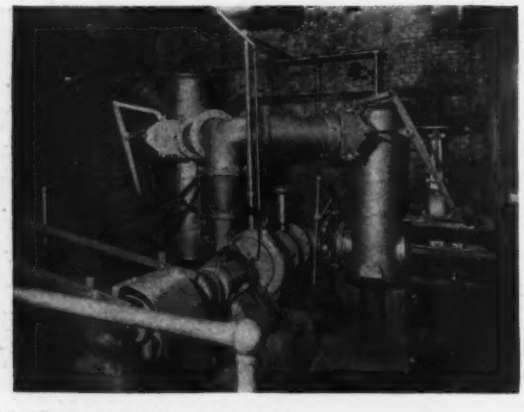


Courtesy Johns-Manville Corp.

FIG. 9
Transite 16-Inch Groundwood Stock Line

valves and pumps are exposed to destructive chemical reactions which in themselves are numerous and exacting. Great volumes of liquids and gases are conveyed in the commercial sizes of pipe, but in many instances in specially made pipe.

The conveyance of fluids, whether gaseous or liquid, is a complex engineering subject requiring



Courtesy Worthington Pump & Mchy. Corp.

FIG. 10
6-FP-1 Paper Stock Pump, Belt Driven, Handling 870 GPM, 5% Groundwood Stock Against a Total Dynamic Head of 80 ft. at a Speed of 950 RPM. The Pump is Installed in an Eastern Groundwood Mill

Courtesy Walworth Co.

FIG. 11
Walworth Fig. 726F I. B. Bronze Mounted Gate Valves on Water Lines

knowledge and experience in engineering materials, pipe layout and design, hydraulics, etc. Management should keep this in mind and employ engineers to study the problems, to make recommendations, and supervise installations and maintenance in order to keep the cost factors of materials, power, depreciation, installation, and maintenance at a minimum.

Pipe, pumps, and valves are required for all the usual purposes in steam generation and conveyance —vacuum, low, medium, and high pressure, both saturated and superheated.

Pipe, pumps, and valves are required for fresh water and water for processes, fire protection, feed-

Courtesy Walworth Co.

FIG. 12
Installation of Walworth I. B. Gate Valves of Special Alloy Trim on Steam Service. Also C.N.I. Pipe on Condensate

POWER PIPING

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Like fighting planes and tanks and guns, plant equipment for defense production must be built to higher standards than ever before. In power piping, ever-higher operating temperatures and pressures create new problems in fabrication engineering that can be efficiently solved only by competent specialists.

Grinnell engineers are power specialists equipped by long experience to interpret new high-pressure, high-temperature requirements into speedily-erected, underwriter-approved piping systems for any type of plant. Backed by complete fabrication facilities at strategic locations, Grinnell Piping Prefabrication is helping industry to meet new "fighting" standards of power production.

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PREFABRICATED PIPING BY **GRINNELL**

WHENEVER **PIPING** IS INVOLVED

water, blowoff, makeup, effluents, hot, condensate, and high- and low-pressure hydraulic.

Under miscellaneous pipe, pumps, and valves, we may include equipment for liquid or gas fuel, compressed air, lubrication systems, oil hydraulic systems, etc.

In this discussion, the movement of air for ventilation and for aid in drying is not covered, although it is a problem of pumping, because the subject requires handling of fluid not contemplated in this paper. The conveyance of flue gases constitutes another important problem not discussed.

Chemical and Mineral Materials

The following chemicals and chemical solutions are among the many used in the pulp and paper industry: acetic acid, alcohol, aluminum sulphate, ammonium hydroxide, ammonium sulphate, boric acid, calcium carbonate, calcium oxide, calcium sulphate, carbon tetrachloride, casein, chlorine, clay, detergents, dyes, formaldehyde, glue, glycerine, hydrochloric acid, hypochlorite, kerosene, latex, resins, rosin, soaps, sodium aluminate, sodium carbonate, sodium chloride, sodium hydroxide, sodium pentachlorophenate, sodium silicate, sodium sulphate, starch, sulphur, sulphuric acid, sulphur dioxide, titanium dioxide, waxes, zinc compounds. The gases include air, sulphur dioxide, carbon dioxide, chlorine, hydrogen sulphide, mercaptan, etc.

Engineering Materials Selection

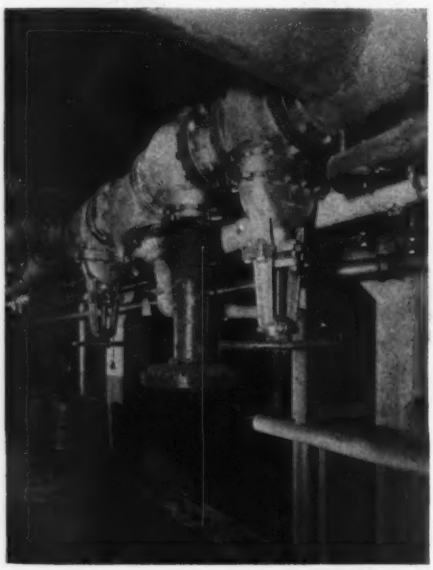
Each application of a material in a phase of operation should be made only after due consideration has been given to the factors involved—e.g., initial cost, installation costs, length of life. The selection of proper pipe materials is dependent on velocity of fluid, its composition, abrasive solids in suspension, and temperature. In addition the engineer must decide whether to use cast, spiral welded, seamless, etc., pipes and tubes.

On some services, considerable difference of opinion prevails concerning the durability or life expectancy of a material; however, in many cases the problem is solved by good engineering. It is beyond the scope of this article to deal with specific applications. The fact that a certain material has been used successfully in a particular phase in one mill's operation does not necessarily mean that that material will be satisfactory in another mill on a similar application. If every variable—e.g., temperature, chemical composition including the makeup water, velocity—of the phase in the two mills is the same the durability should be the same. Fortunately, precise control of every variable is not necessary in many operations provided certain fundamentals of engineering are followed.

The materials used for pipe, pumps, valves, and packing in the power plant will not be discussed because, in general, the specification of materials is standardized to a considerable degree. *(See* Figs. 11 to 13.)

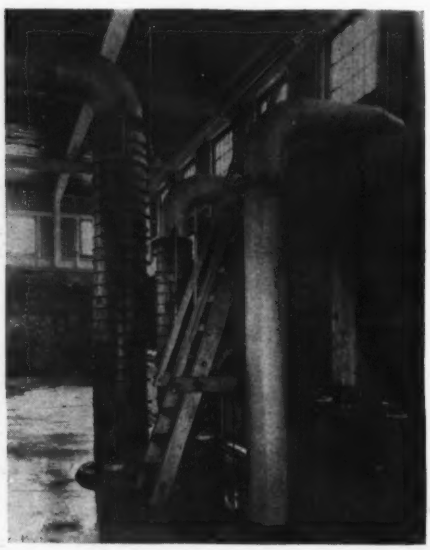
Courtesy American Brass Co.

FIG. 14
Everdur Pipe Lines and Fittings for Sulphite Pulp Suspensions



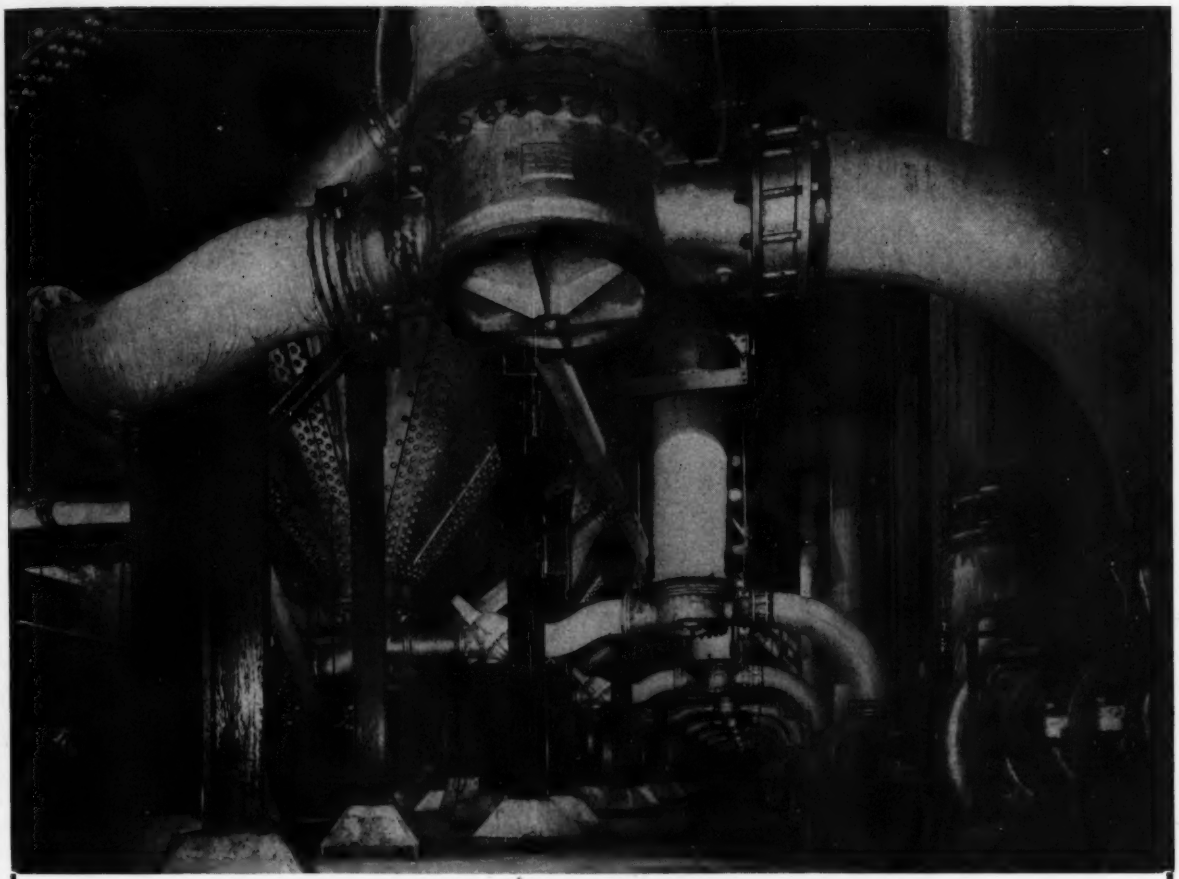
Courtesy Walworth Co.

FIG. 13
Walworth Fig. 725F.S. Valves on Steam Lines



Courtesy American Brass Co.

FIG. 15
Everdur Pipe Lines and Fittings for Sulphite Pulp Suspensions



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Pulp Manufacture

The consistency of pulp suspensions is varied throughout the manufacturing operation but in conveying the suspension from one phase to another the consistency is low so that it can be pumped. The pulp goes through several cycles of watering and dewatering operations.

In *mechanical* pulping, the fibers of the wood are separated by grinding it against a revolving stone. Water is the principal fluid used in this process. From the grinder (Fig. 1), the fibrous suspension passes to the screens then to wet machines or thickeners where much of the water is separated from the fibers if it is to be shipped or stored. The pulp may be stored, shipped, or conveyed to the papermaking machines.

In general the materials used for pipe consist of wood, copper, wrought iron, steel, Transite, rubber, galvanized, and various alloys.

Sulphate pulp is made by cooking wood chips in a digester with a sodium sulphide liquor; and the *soda* process is similar, using a sodium hydroxide liquor. These processes are known as the alkaline processes.

Figure 2 shows the typical fluid flow in the manufacture of sulphate pulp. The legend for Fig. 2 describes the service and the nature of the fluids. In considering Fig. 2 it should be remembered that the pulp mills have up to 5, 10, or more digesters, diffusors, etc., which multiplies the amount and complexity of the piping, pumps and valves.

In one mill, wrought iron and carbon steel are used except for Item 23 (Fig. 2) where chromium-nickel iron pipe is used. One mill uses carbon steel except for Items 15, 17, 18, 19, 22, 24, 26, 27, and 29 where chromium-nickel iron is used. One mill uses copper steel in Items 23 to 25. Copper, bronze, Monel, stainless steel, and rubber are used in large quantities also.

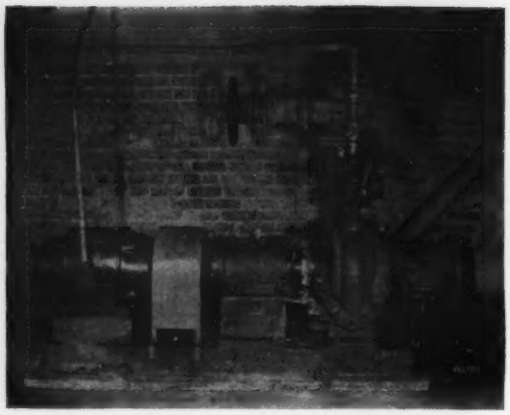
In Fig. 2, the numbers encircled represent pumps and also major pipe lines. For each line, the requisite valves are required. Auxiliary, small, and bypass lines are not shown although from a tonnage viewpoint, the amount is appreciable and important. The items marked No. 1 effect, etc., are evaporators. The black liquor concentration increases as the liquor passes through each effect. Each evaporator effect contains a large number of small diameter tubes made from carbon steel, stainless steel, Monel, CNI or other alloys.

Figure 1 shows the flow of the fibrous suspension to the papermaking operations and the completed paper. A study of Figs. 1 and 2 will give a fairly clear understanding of the similarity of the soda to the sulphate process of pulping.

Sulphite pulp (*see* Figs. 14 to 17) is made by cooking wood chips in a digester with an acid liquor. The fumes and fluids in sulphite pulping are extremely corrosive. Pipes of lead have been used extensively where their mechanical properties would permit. Lead with tellurium added is used in some cases because of the improvement in mechanical properties.

Acid-resistant bronzes and copper are utilized for acid and stock lines, valves, and pumps.

Steels, containing nickel, chromium, manganese, copper, silicon, or molybdenum or combinations of these elements are used for some sulphite pulp mill services.



Courtesy Worthington Pump & Mchy. Corp.

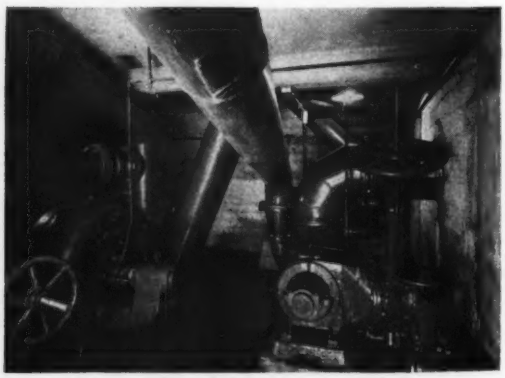
FIG. 17

Worthington 4-FP-1 Centrifugal Paper Stock Pump, Handling 550 GPM of 3½% Sulphite Stock against a 45-ft. Head, and Driven by 15 HP, 1150 RPM Motor. The Pump Is Installed in a Midwest Sulphite Mill

Courtesy American Brass Co.

FIG. 16

Everdur Pipe Lines and Fittings for Sulphite Pulp Suspensions



Courtesy Shartle Bros. Machine Co.

FIG. 18

Breaker Disintegrator Pump Installation in Paper Mill

Courtesy Shartle Bros. Machine Co.

FIG. 19
Combination Agitators and Centrifugal Pumps Installation in 150-Ton Paperboard Plant

Glass pipe is used by some mills for various corrosive fluids and is adapted for use to withstand pressures up to at least 100 p.s.i.

Wood pipes are used for pulp suspensions and water.

Wrought iron pipe offers good resistant qualities for handling many liquids.

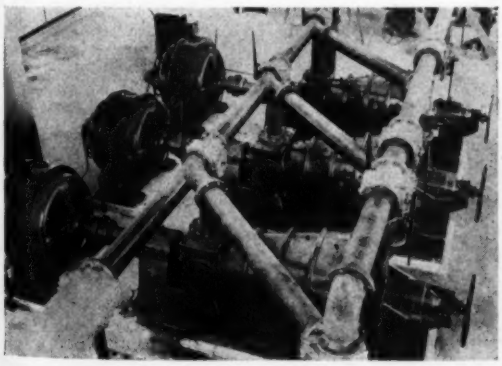
Flow of Fiber Suspension

In Fig. 1, the flow of the fibrous suspension is shown from the digester through to the completed paper. In some respects, the equipment is similar to that used in the alkaline processes. The piping, pumps, and valves, are similar also but the chemicals and the materials of construction vary in various phases.

Paper Manufacture

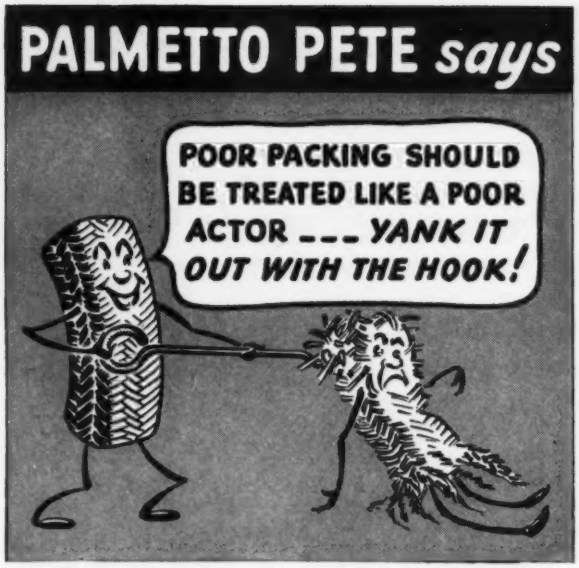
Figure 1 shows the flow of pulp to the papermaking operations and points where chemicals are usually added to the pulp suspension (*see* Figs. 18 to 21). The pulp suspension is pumped from beaters or may flow by gravity to chests from which it is pumped to the jordans, regulators, and screens. From the screens, the suspension flows to the paper machine headbox. The chemicals shown in Fig. 1 are only a few of the chemicals that may be used in papermaking.

The suspension usually leaves the headbox of the paper machine at a consistency of 0.5%, thus to supply a 100-ton paper machine at this point about 20,000,000 pounds of fluid (fibrous suspension) must



Courtesy Shartle Bros. Machine Co.

FIG. 20
Jordan Installation Showing Pipe and Valve Layout in Paper Mill



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PACKINGS
9 out of 10 who try them, buy them

be pumped each 24 hours. To furnish the stock for one paper machine, several beaters, jordans, and screens are used. This necessitates interconnecting piping in many cases where more than one paper machine is installed.

Most of the chemicals used are dissolved or dispersed before they are added to the pulp suspension. These are, in many instances, made up in batches and stored in tanks so that measured quantities can be pumped through pipes to the beaters or other stuff preparation equipment.

Many paper mills have 2, 3, 4 or more papermaking machines and to afford flexibility of all the equipment, the pipe layout and design becomes complex.

Courtesy Worthington Pump & Mchy. Corp.

FIG. 21

Worthington 6-FP-1 Paper Stock Pump, Multi-V Belt Driven, Handling 550 GPM of 3½% Waste Paper Stock Against a 45-ft. Head at a Speed of 860 RPM installed in an Eastern Board Mill

The engineering material used for packing, pumps, and valves, in one phase may not be suitable for other phases of the papermaking operations due to chemical composition, temperature, solids, vibration, etc.

In paper manufacture, the materials used for piping, pumps, and valves cover the entire range of those used in pulp manufacture; but it is generally conceded that the services on the whole are not as severe.

Pulp Bleaching

After the pulp comes from the digesters in the chemical pulping processes, it receives several washings to remove the chemicals and noncellulosic constituents of wood which do not adhere to the fibers. These washing operations do not make the pulp white. Acid-process pulp may be a deep yellowish color and alkaline-process pulp may be a deep brownish color.

The pulp is whitened by bleaching—generally with chlorine and hypochlorite, although other bleaching chemicals are used to a much lesser extent. The chemicals used for bleaching may be divided into two classes, the oxidizing and the reducing agents. The oxidizing agents include hypochlorites, chlorine and hydrogen peroxide. The reducing agents include calcium bisulphite, sodium sulphite, and zinc hydrosulphite.

The purification of pulp is done in single and multistages. In either the single-stage or the multistage processes, pumps, piping, and valves form a major part of the equipment for conveying the

SAVE
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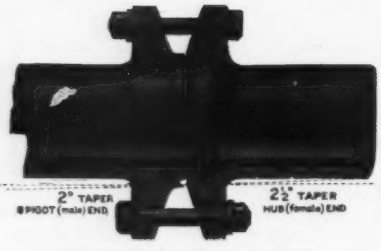
UNIVERSAL CAST IRON PIPE



THE UNIVERSAL BOLTED JOINT

No caulking or pouring of lead or lead substitutes. No bell holes to dig, no gaskets.

Outstanding Advantages

1. No caulking or pouring of lead or lead substitutes. No gaskets used.
2. No bell holes to dig. Can be laid in a narrow trench. Cost of wide trenching is eliminated.
3. Can be laid with speed. Easier and cheaper to install because only two bolts need to be inserted in the lugs, tightened with a ratchet wrench and the completed joint is made in a few minutes. The only tools needed are ratchet wrenches to make the joint. Experienced workmen unnecessary. Can be laid with ordinary labor. Joints are tapered and are machined iron-to-iron joints.
4. Nothing to deteriorate; nothing to work loose; no leakage; eliminates maintenance cost.
5. Flexibility. Universal Cast Iron Pipe is very flexible. Many curves are laid with straight lengths and do not need special fittings. Six foot lengths easy to handle and easy to lay. Withstands expansion, contraction, unequal settlement, vibration and shock and electrolysis.
6. Can be laid on rocky soil, under water and in sub-zero weather.

Uses of Universal Cast Iron Pipe

Paper Mill, water supply and distribution lines, high pressure fire service, sewage disposal systems, industrial water supplies, mine water drainage and irrigation.

Types of internal coating available on Universal Cast Iron Pipe Fittings.

1. Cement lined 2. Enameline

Because of its speed and ease of installation, Universal Cast Iron Pipe saves labor, time, money and costly equipment.

Service to Customers: Quick service by rail, truck or water from our foundries and warehouses located from coast to coast.

A joint is made with only a ratchet wrench as field equipment.

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I am interested in saving Time, Labor, Money and Field Equipment. Send me the Universal Cast Iron Pipe Catalog.

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Position .....
Street .....
City ..... *State* .....

chemical fluids, pulp suspensions, and process water. Because some of the chemicals are extremely corrosive, careful study of the corrosion-resistant properties of engineering materials to be used in the bleach plant is necessary before a selection is made.

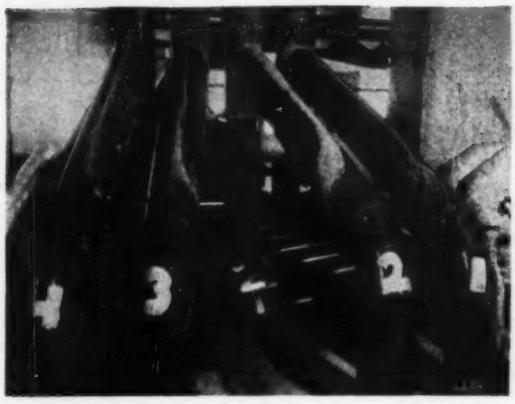
United States Production of Pulp and Paper

The Bureau of the Census, United States Department of Commerce, issued the following summary of the pulp and paper industry for 1939:

Establishments	802
Wages and salaries	$214,565,911
Employees	152,140
Cost of materials, supplies, fuel, purchased energy and contract work	$676,997,167
Value of products	$1,159,867,484
Value added by manufacture	$482,870,319
Paper and Paperboard Production (tons)	13,509,642

The year 1939 was not chosen here because of any spectacular statistics but merely because it is the latest year for which official figures are available. The above table includes paperboard mills as an integral part of the paper industry. (Reference to the pulp and paper industry includes paperboard.)

The pulp production figures for 1940 as given in Table I show that the pulp mills in the United States manufactured 6,313,000 tons of sulphite and sulphate pulp or nearly 13 billion pounds of chemical pulp. The mechanical (groundwood) pulp production was 1,961,000 tons or nearly 4 billion pounds. The soda pulp production was 542,000 tons, and the semi-chemical and special pulp production was 165,000 tons. In addition to the domestic production of pulp, a large tonnage is imported for conversion into paper. The estimated 1940 production of paper is 14,483,709 tons. When it is considered that the pulp goes through several stages of watering and dewatering, that pulp being bleached does the same, and that the pulp suspension going to the paper machine is at ½ of 1% consistency, the thousands of pumps and valves and the miles of piping used necessarily become items of tremendous importance.

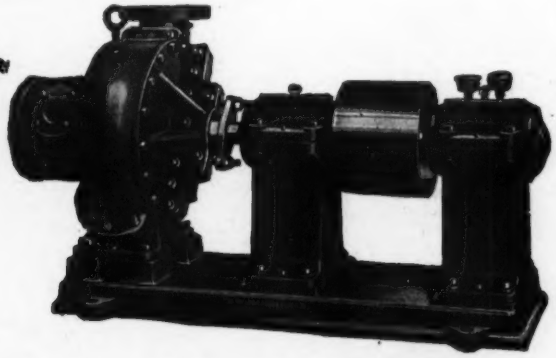


Courtesy American Rolling Mill Co.

FIG. 22
ARMCO Spiral Welded Pipe Carries Stock in an Ohio Boxboard Mill

The Office of Production Management estimates that the paper requirements for 1942 will be about 18,000,000 tons from United States mills and the total requirements at about 26,000,000 tons of which about

The MODERN STOCK PUMP . . .



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to meet the operating conditions for which they are sold!

● **Extra-heavy shafts, made of chrome heat-treated steel, are carried in long babbitted sleeve bearings, arranged for ring oiling. Non-clog impeller wheel is designed specially to permit easy flow of heavy stock. Patented, adjustable liner plates, on front and rear sides of the impeller, make adjustment or replacement easy. Extra-long packing box houses twice the usual number of rows of packing. *Ask about the many other features.* . . .**

Frederick PUMPS

product of The FREDERICK IRON & STEEL COMPANY ● FREDERICK, MD.

TABLE I.—PULP PRODUCED IN 1940 IN THE UNITED STATES

Kind of Pulp		Tons
Sulphite Pulp, unbleached		977,000*
Sulphite Pulp, bleached, paper grades	1,323,500	1,612,000*
Sulphite Pulp, bleached rayon	288,500	
Sulphite Pulp, unbleached		3,171,000*
Sulphate Pulp, bleached		553,000*
Mechanical Pulp		1,961,000*
Soda		542,000
Semichemical and Special		165,000

* From United States Pulp Producers Association report of February, 1941.

4,000,000 tons are expected to be imported, leaving an estimated shortage of 4,000,000 tons.

The total production of paper and paperboard during August was at the annual rate of 18,000,000 tons. September production fell slightly due to holidays but preliminary information indicates that the production in October was at an annual rate of about 18,700,000 tons. The production ratio report (basis 6-day operating capacity) of A.P.P.A. gives the monthly percentage as 85.5 for October, 1940 and for October, 1941 it has increased to 105.4%.

Conclusion

There are several parts of the pulp and paper industry which have not been discussed, although their importance should not be underestimated—e.g., *reclamation* of waste papers which includes defibering, cooking, deinking, washing, screening, etc.; *coating* of paper with its many requirements for pumps, valves, and pipe; and the power plants.

Acknowledgment

Figure 1 is used with the permission of Benton Cancell of A.P.P.A. who prepared it with some assistance by the author and W. G. MacNaughton of the News Print Service Bureau. The author thanks A. H. Johnson of Johnson & Wierk; Tom Ireland of Crane Co.; J. W. Hemphill of Johns-Manville Corp.; and Frank Cole of Walworth Co. for helpful suggestions or review of the manuscript.

Additional Information

For details of pulp and papermaking, readers are referred to the textbooks entitled: The Manufacture of Pulp and Paper, published by McGraw-Hill Book Co., under the sponsorship of the Joint Textbook Committee of the Technical Section of the Canadian Pulp and Paper Association and the Technical Association of the Pulp and Paper Industry.

Courtesy American Rolling Mill Co.

FIG. 23
ARMCO Spiral Welded Pipe Brings the Main Water Supply to a Southern Mill

IT'S THE WOOD

that makes RAINS a better—yes, a very much better — than ordinary stuffing box packing.

Impregnated soft wood units provide

Hundreds of Tiny Reservoirs of Lubrication

Think of the constant protection this gives those precious rods, plungers, and shafts about which many are having "priority jitters" these days, when it comes to their replacement.

This GOULD "white water" PUMP in a Pacific Northwest mill has been exclusively RAINS PACKED *since 1927.* Only one shaft sleeve replacement has been made in this period—in 1940. *A 13-year service record* with a single ring of packing being added on an average of each eight months.

Osmosis, or the tendency of a stored liquid outward, provides constant lubrication over long periods with Rains Packings.

Packed 10 feet per box—¼-inch to 1-inch Protect rods, plungers, and shafts *NOW, while they are still in good condition!*

With

RAINS Wood Metal **PACKINGS**

"Like Self-Lubricated Bearings"

900 Broadway — Spokane, Wash.

Government Paper Bids and Awards

WASHINGTON, D. C., Nov. 26, 1941—Government Printing Office has received the following bids for 6,700 pounds of 14 x 19 offset book paper; R. P. Andrews Paper Company, 8.65 cents; Stanford Paper Company, 9.68 cents; Paper Corporation of U. S., 12 cents; and Butler Company, 8.715 cents.

For 138,700 pounds of same 47 x 61½; Marquette Paper Company, 9.45 cents; Stanford Paper Company, 9.13 cents; Whitaker Paper Company, 8.3 cents; Paper Corp. of U.S., 9.1 cents; and Butler Company, 8.715 cents.

R. P. Andrews Paper Company has been awarded the contract for furnishing the Government Printing Office with 444,000 pounds of 32½ x 42½" white mimeograph paper at 7.05 cents, bids for which were received on November 14. Other paper awards announced include the following.

Barton, Duer & Koch Paper Company will furnish 200,000 pounds of buff wood bristol board in 22 inch rolls at 6 cents; R. P. Andrews Paper Company will furnish 300,000 pounds of supercalendered paper in 28½ inch rolls at 6.8 cents. The Paper Corporation of U.S. will furnish 12,000 pounds of wood manila paper in 36 inch rolls, at 6.5 cents. R. P. Andrews Paper Company will furnish 10,960 pounds of 29 x 41 buff offset book paper at 11.04 cents. Bids for all of these items were received on November 14.

Virginia Paper Company will furnish 20,400 pounds of 28 x 34 blue sulphite writing paper at 9.5 cents and Marquette Paper Company will furnish 56,100 pounds of 32 x 42 yellow sulphite writing paper at 10.81 cents. Butler Company will furnish 300,000 pounds of white sulphite writing paper in 32 inch rolls at 7.6 cents. Paper Corporation of U.S. will furnish 63,000 pounds of offset book paper in 67½ inch rolls at 8.6 cents. R. P. Andrews Paper Company will furnish 6,700 pounds of 14 x 19 offset book paper at 8.65 cents and Whitaker Paper Company will furnish 138,700 pounds of the same 47 x 61½ at 8.3 cents. R. P. Andrews Paper Company will also furnish 417,750 pounds of 39⅜ x 56 white antique book paper at 7.26 cents. Barton, Duer & Koch Paper Company will furnish 40,000 pounds of 50% rag, blue manifold paper in 24 inch rolls at 6.8 cents. Bids for all of these items were received on November 12.

Paper Corp. of U.S. will furnish 45,150 pounds of 50% rag, 44 x 64 lithograph finish map paper at 16.75 cents, bids for which were received on November 7.

R. P. Andrews Paper Company will furnish 250,000 pounds of 42 x 62 litho finish poster paper at 7.5 cents.

National Pulp & Paper Company will furnish 200,000 pounds of newsprint paper in 24 inch rolls at 2.9 cents and the Mudge Paper Company will furnish 7,146 pounds of 38 x 48 jute tagboard at 11.5 cents. Bids for these items were received on November 5.

Mudge Paper Company will also furnish 54,000 pounds of 24½ x 34 lined box board at 11 cents, bids for which were received on November 3.

Brown Paper Company will furnish 20,000 sheets of 15 x 21 parchment paper at 36.5 cents, bids for which were received on October 31.

R. P. Andrews Paper Company will furnish 100,000 pounds of 39⅜ x 66 white sulphite writing paper at 7.9 cents and the same amount will be furnished by Mead Sales Company, Inc., at 7.225 cents.

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THE SANDY HILL IRON & BRASS WORKS

Hudson Falls, New York **U.S.A. Manufacturer**

University of Minnesota Conducts Waste Survey at Plant of M. & O. Paper Co.

By F. B. Rowley[1] and R. C. Jordan[2]

During the past year the Engineering Experiment Station of the University of Minnesota, under a research agreement with the Minnesota and Ontario Paper Company, has been conducting a survey of all waste sources at the paper company's International Falls plant. The processes conducted at this plant include the manufacture of sulphite, kraft, and ground wood pulp, and the manufacture of paper and insulation board. The purposes of this survey were twofold: first, to determine and measure any major sources of recoverable loss; second, to determine and measure the principal sources of stream pollution. All measurements have been made on both a quantitative and a qualitative basis and have been correlated with plant production.

Complete flow charts and sewer diagrams were first drawn for the entire plant, and the sources of waste located on these. Individual sources of loss were found which discharged either to the sewers or to the atmosphere, and each of these was studied separately. The methods used in the measurement of these losses are here classified and discussed according to the manufacturing process.

Wood Room Losses

A wood balance was conducted on the wood room with continuous measurements of the input and output made for four and one-half days. Measurements were made of the wood input on both a weight and cordage basis, the sawdust from the slashers, the sawdust from the chipper screens, the bark sent to the boiler house as hog fuel, and the bark and sawdust discharged to the sewers. The velocity of flow in the channel carrying the bark to the sewers was measured by means of a Pitometer and checked by the dye method. Samples of the bark were taken every half hour at different levels of the channel and screened successively through five, ten, and twenty mesh screens, and the effluent was filtered. This enabled a size analysis of the bark and sawdust discharged to the sewers. Approximate measurements of the amount of bark entering the wood room checked the measurements made of the amount leaving within less than eight per cent by weight.

[1] Director, Engineering Experiment Station, University of Minnesota.
[2] Assistant Professor, Engineering Experiment Station, University of Minnesota.

FIG. 1
Portable Weir Channel and Inclined Saveall for Measurement of Knots and White Water from Knotter Screens

FIG. 2
Apparatus for Measurement of Smelter Stack Salt Cake Losses

Sulphite Pulp Mill Losses

Sulphite pulp mill measurements were made of the sulphite liquor discharged to the sewers, and investigations were carried out as to the volumes and SO_2 content of the gases discharged from the acid towers and the blowpits.

The volume of sulphite liquor was measured by displacement. After blowing the digesters, a sufficient volume of water was added to the blowpits to bring the level up to a predetermined point. The pits were then drained thoroughly, refilled with water, and the volume of liquor determined by difference. Representative samples of the liquor were taken, and the total solids and fiber losses determined.

Kraft Pulp Mill Losses

In the kraft pulp mill measurements were made of the lime sludge discharged to the sewers and of the salt cake and black ash losses in the gases discharged from the smelting furnaces.

Three continuous two-day tests were conducted in which investigations were made of the lime sludge losses. Just prior to the time of discharge, the vol-

WATER CONTROL
Speeds production in paper mills!

Capacity operation increases need for soft, clear, iron-free process water

URGENTLY needed products must not be spoiled by spots, stains and streaks left by untreated water. Waste cannot be tolerated. Hard-to-replace equipment must be protected from damaging scale deposits and from corrosion. Shutdowns to turbine boiler-tubes are out of the question.

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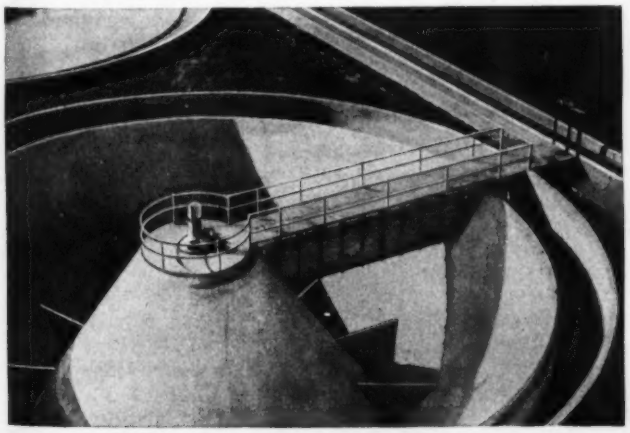

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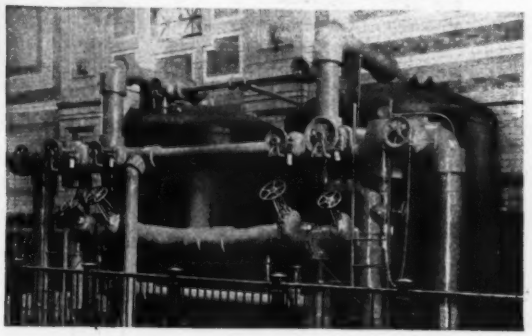


PERMUTIT

WATER CONDITIONING HEADQUARTERS

ume of sludge in the tanks was measured, and samples of this sludge were taken for analysis. The sampler used was designed to remove a complete vertical column of the sludge, thus taking into account any stratification of the insoluble suspensions in the samples. The weight of total suspended solids per unit volume of sludge, the per cent of total soda, and the per cent of free lime were determined on these samples.

In determining the salt cake losses from the smelter stacks, several eight-hour periods of continuous measurement were made in which Pitot tube velocity traverses and thermocouple temperature traverses were taken each hour, and the salt cake and black ash entrained in the gases were measureed for a fifteen cubic foot sample each hour. These samples were obtained by passing the gases through three Smith-Greenburg impinger bottles placed in series (see Fig. 1). This sampling was accomplished by means of a calibrated pump operating continuously at 1 c.f.m. The Smith-Greenburg sampling bottles are similar to those used in the determination of atmospheric dust concentration. In the present tests, preliminary measurements made to determine the efficiency of this apparatus for the removal of salt cake from the smelter gases indicated that the three Smith-Greenburg bottles placed in series would remove approximately 98 per cent of the salt cake contained in the sample.

Screen Room and Paper Machine Losses

In the study of the white water losses, no measurements were made of the composite losses in the sewers. Instead, the individual sources from the various machines were studied and the total loss determined by integration. Although this involved considerably more work, it enabled not only the determination of the total waste discharged to the sewers but also analysis of the efficiencies of the various machines. In making these studies, a portable weir channel, 7 feet 2 inches by 3 feet 9 inches by 3 feet 6 inches, constructed of 14 gage galvanized iron was

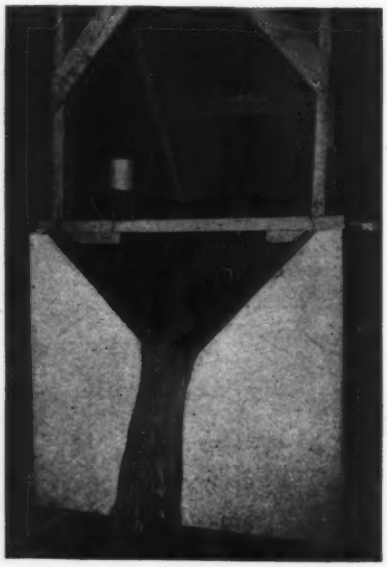


FIG. 3
Close-Up View of Weir Channel Showing Water Level Recorder and Timing Device for Automatic Sampler

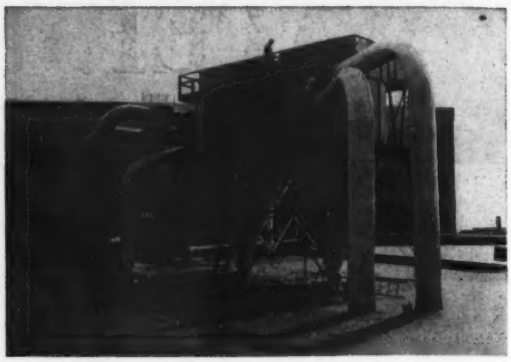


FIG. 4
Measuring Velocity of Discharge from Cyclone Dust Collector

used (see Fig. 2). The weir itself was of the V-notch type in order to permit accurate measurements of both high and low discharge and was designed to measure rates of flow as high as 2,000 g.p.m. The channel was equipped with both rock baffles and streamlining baffles to decrease turbulence. Prior to the running of any tests a complete calibration of the weir was made by actual measurements of the volumetric discharges at various heads. During tests of the white water discharge to the sewers, sampling was accomplished automatically every nine minutes with the size of the sample approximately proportional to the rate of flow, and the head on the weir was recorded continuously by means of a water-level recorder. The white water samples collected were analyzed to determine the weight of total suspended solids, fixed suspended solids, volatile suspended solids, total dissolved solids, fixed dissolved solids, and volatile dissolved solids. These analyses were carried out in accordance with the TAPPI standard method of measuring white and waste waters.[8]

In interpreting the results of these analyses it was considered that the volatile suspended solids represented the fiber losses and the fixed suspended solids, the majority of the filler losses. Continuous measurements and analyses were made of the white water discharged to the sewers from the individual machines in a series of tests ranging from two to four days in duration. These included tests on the tailing screens, suction boxes, wet lap machines, white water chest overflows, savealls, and deckers. In addition to the white water analyses, comparative studies were made of the fibers contained in the white water by means of photomicrographs of slides prepared from samples taken from each of the sources of loss.

Measurements were made of the knots and slivers and also of the fines contained in the discharge from the knotter screens by means of an inclined saveall and the weir channel described above. During tests, the knots separated by means of this saveall were weighed and analyzed, and samples of the water discharged through the weir channel were collected and analyzed for suspended and dissolved solids.

A survey was made over a six-months period to determine the average amount of stock discharged to the sewers from the beaters, chests, and rifflers upon washouts. Measurements were made of the amount of stock and their consistencies at the time

[8] "Measuring, Sampling, and Analyzing White Waters," *Paper Trade Journal, III:26, Dec. 1940.*

of washout in a number of cases, and the number of washouts was recorded for the entire period.

Insulite Plant Losses

A thorough study was also made of the various losses found in the Insulite plant. Again white water measurements were made of all individual sources of white water loss by means of the portable weir channel previously described. These losses were correlated with machine production and also integrated to determine the entire loss for the plant.

In the Insulite plant a considerable amount of dust is created by the cutting and trimming of insulation board, and much of this is recovered by exhausting through cyclone dust collectors. However, there is some discharge to the atmosphere from these cyclones, and measurements were made to determine the magnitude of this loss. Several eight-hour tests were made in which velocity traverses were taken of these discharges hourly, and continuous samples were collected at the discharge by drawing the air-dust mixture through Alundum crucibles by means of a calibrated pump. These crucibles were dried and weighed before and after the tests to determine the amount of dust removed. In sampling, the sampler was made to traverse the discharged duct once every 30 minutes, with the time of sampling at each station in proportion to the velocity at that point.

In drying the insulation board, there is some loss of volatiles in addition to the moisture driven off in the kilns. This loss was determined by subjecting a sample of the board to the usual kiln high-temperature drying process and an adjacent sample to slower low temperature drying. By comparison of the changes of weight of the two samples, it was possible to arrive at the weight of volatiles driven off by the kiln process.

The results of this survey are already proving of value as the magnitude and location of all losses are now accurately known. Steps have already been taken to eliminate some of these losses and plans are under consideration for the utilization of many of the other waste sources. This paper has presented merely a brief resume of the extent of the project and some of the procedures adopted. It is intended that the detailed procedures and results of the survey will be published as a bulletin of the University of Minnesota Engineering Experiment Station in the near future.

Equipment by F. X. Hooper Co.

The F. X. Hooper Company, Inc., Glenarm, Md., was established in 1882 and is said to be the oldest concern of its kind in the country. The company manufactures the following line of equipment for the shipping container industry:

Printers. Corrugated—printing on sheets, boxes, etc., for use as shipping containers. Solid Fiber—printing on sheets, boxes, etc., for use as shipping containers. Wood-shipping cases, boxes, specialties, toys, cigar boxes, cheese boxes, shooks, mouse traps, yard sticks, window glass boxes, etc. Metal—barrel heads, pail bodies, galvanized sheets, flat rigid stock, etc.

Super-Production Printer Slotters—printing corrugated board at over 200 sheets per minute in one or two colors, slotting and scoring to make sheet ready for folding into box.

Complete combined Corrugating Units—for corrugating paper at 300 feet per minute, into board sheets ready for printing and slotting. These units are composed of single facers, tandem or duplex "A & B" single facers. Adhesive mechanisms, double facers, duplex or triplex slitters, rotary precision cutoff knives, etc.

High Speed Rotary Non-Stop Balanced Precision Cutoff Knives, Single or Duplex—for cutting corrugated, fiber, asbestos board, paper, etc., into exact sheets lengths at high speeds.

Single Face Choppers—For cutting and slitting single face corrugated paper board and partition material to proper length.

Slitters and Scorers—2, 4 or 6 bar—for heavy duty, high speed slitting, trimming and scoring of corrugated and fiber board sheets and cigar box blanks.

Panel and Offset Scoring, Flap Cutting, Stitch Lap and Special Fiber Type Slot Devices and Attachments—for scoring, cutting and slotting corrugated and fiber board on plain slotters and printer slotters.

Plain Slotters and Automatic Stackers—for high speed slotting and stacking of finished pieces.

Sheet Piling, Counting, Slow Moving and Special Deliveries—for fast, efficient handling of printed, and/or slotted pieces after completely finished on slotters and printers.

Pad and Partition Machinery (Automatic)—for fast production of dust free interior packing pieces, slitted and slotted partitions for packing glassware, etc.

The following machines are built only to special order and for specific production problems. Due to special engineering and design necessary, they cannot be considered to be in the regular Hooper line of equipment:

Multi-Color Web Offset Presses—printing from one to five colors in one operation at very high speeds.

Special Printing Equipment—for printing on milk bottle caps, wall board, masonite, celotex, flat rigid metal sheets, etc.

Paper Processing Equipment—for coating paper stock.

Wertheimer Estate Now $433,791

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., November 24, 1941—A final accounting has been made in New York of the estate of the late Monroe A. Wertheimer, chairman of the board of the Thilmany Pulp and Paper Company, Kaukauna, Wis. He died March 1, 1939, leaving $781,203, of which $433,791 remains. The executors reported that the capital has increased $84,608 since the beginning of the accounting on March 1, 1939, making the gross estate $865,811.

Payments have been made to legatees totalling $255,590. Administrative expenses were $18,237 and losses were $10,586. Estate taxes amounted to $115,841 and claims to $32,035.

Mr. Wertheimer's will directed that his widow receive one-half the net income of the estate, up to $15,000, during her life or until remarriage. The remainder of the income is left to Robert S. Wertheimer, the son, of Longview, Wash., who will receive the entire principal at the expiration of the trust.

Black-Clawson, Shartle, Dilts Equipment

A new tangential inlet classifiner has recently been announced by the Dilts Machine Works Division of the Black-Clawson Company. The classifiner which is illustrated in Fig. 1 was developed with the express purpose of providing a medium for replacing pulp screens and settling troughs in mixed paper systems, thus saving on floor space and making the pumping of large gallonage of white water unnecessary.

With less white water used, greater capacity is secured from the thickeners. Handling stock at 1¾% instead of 1%, for example, means 996,000 less gallons required per day per 100 tons, hence there is considerable savings in pumping power, piping, etc.

The classifiner is now built with a new tangential inlet designed to utilize to the fullest extent the centrifuging action of the incoming stock and the rotation of the impeller. Periodic bleedoff is provided with time operated valves so that the heavy abrasive material is constantly ejected from the system. Simultaneously, a similar reject valve emits the light floating material from the center of the classifiner where it has accumulated due to the centrifuging action of the unit.

FIG. 1

FIG. 2

Meanwhile, all defibered stock is being screened through ⅛ inch perforations in the twin screen plates. That portion of stock reaching the classifiner in flakes too large to pass is subjected to a violent slushing action and is further refined by the action of the scraper in cleaning the perforations of accumulated material such as cellophane, rubber, strings, etc. Hence only clean stock of uniform size is passed on to thickener and jordan.

A complete cleaning medium that separates glass, sand, metal, strings, rubber, wood, cellophane, etc., and delivers a uniform pulp to subsequent operations has been condensed into a single, compact unit. The fibers are not harmed or shortened. Very little hydrating effect is secured since the action is purely one of defibering. But by recycling or adjustment of blade arrangement, a hydrating effect can be secured if desired.

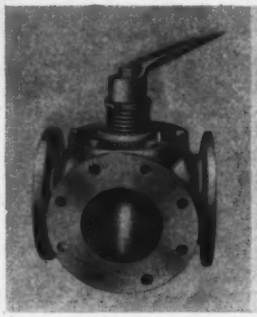


FIG. 3

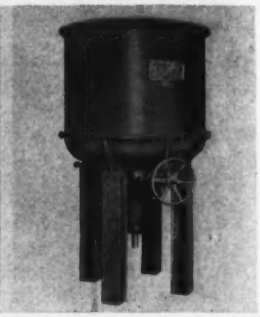


FIG. 4

Given customary care, the classifiner is non-plugging, having been designed to handle trash of every nature. Maintenance is confined to scrapers and perforated plates which both have a low replacement cost and which both are readily installed due to the accessibility of the unit.

Other New Equipment

Other new equipment of more than ordinary interest to the pulp and paper industry is illustrated and briefly described as follows:

New Uniform Speed Reel by Black-Clawson. This reel (Fig. 2) has been designed especially for light weight papers and high speeds. Proven features of simple design result in ease of operation. Uses Black-Clawson seamless driers, equipped with steel journals. Inherently balanced. Low Frames for rigidity and stability. Handles rolls up to 62 inches diameter.

New type rotary valves by Shartle. Many troubles common to older type rotary valves are eliminated by the new Miami valves (Fig. 3). Furthermore, with bottom cover removed and inlet pipe attached, stock can be distributed to three different points with only

FIG. 5

FIG. 6

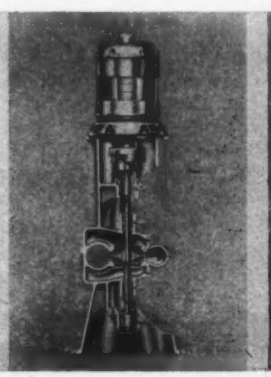


FIG. 7

FIG. 8

If you need

chlorine

BEWOID ROSIN definitely brightens paper, thereby compensating for chlorine deficiency.

SVEEN PROCESS improves opacity as well as brightness.

pigments

That ***SVEEN PROCESS*** can reduce pigment and filler consumption 25% is easily demonstrated with no interruption of production.

alum

30% to 60% reduction of alum by use of ***BEWOID ROSIN SIZE SYSTEM***—also 20% to 40% less rosin to maintain present sizing specifications. Alum reduction measurably improves life of wires and other equipment throughout the paper mill.

For Details Consult

BULKLEY, DUNTON PULP COMPANY
INCORPORATED
295 Madison Avenue New York, N.Y.

one valve, an impossibility with the old type rotor.

New Ten-Ton Hydrapulper by Dilts. Identical in all respects with the larger production units, the new ten ton/24 hour Hydrapulper by Dilts (Fig. 4) is of particular interest to manufacturers of molded paper products and specialties. This ten ton Hydrapulper has a 150 gallon capacity at operating depth. It is four feet in diameter, ten feet in height. It has the same tremendous pulping appetite that enables many mills to feed entire pulp rolls or uncut bales of mixed paper, wires and all. Dilts recommends this new unit for molded paper products, for paper specialties in small tonnages, and for laboratory usage.

New Miami Vertical Pumps

An interesting line of new Miami vertical pumps are illustrated and briefly described as follows:

The vertical Agi-Flo pump (Fig. 5) gives chest agitation and delivery to the next unit in line—all in one compact vertical arrangement. This vertical arrangement makes this pump ideal where floor conditions are cramped or where the room is subject to periodic flooding. For this last condition, a separate shroud is placed around the motor, which permits operation of the pump, even though it is almost completely submerged. Miami vertical Agi-Flo has screw and open impeller. Handles stock up to 8 per cent consistencies.

Miami Class DV Pump. This pump (Fig. 6) requires a minimum of floor space and head room. Top bearing, Timken equipped, bottom bearing water lubricated sleeve type. Shaft completely shrouded to eye of impeller to prevent wrapping of strings and rags. Special side plates reduce possibility of plugging. Cannot air bind. Drains to the last drop of stock. Suction at top of impeller, which means that stock (1 per cent to 6 per cent consistencies) flow directly to the eye of the impeller. Open impeller.

Miami Class AV Pump. A new vertical pump (Fig. 7) for handling large gallonages of water and white water. Is a double-suction, balanced impeller design. Minimum floor space requirements and great accessibility make this pump ideal for crowded conditions. Equipped with heavy-duty anti-friction bearings. Handles stock up to 1 per cent consistencies.

Miami Class JU Pump. This pump (Fig. 8) is designed for sump pump purposes, but also used in chests where pump cannot be set alongside. Contains a minimum number of parts. Top suction means complete drainage of chest. Discharge casing can also be grouted to chest bottom to further complete stock drainage. Adapted to any depth of chest. Open impeller equipped. No packing boxes. Handles consistencies up to 5 per cent.

Complete Vertical Pump Lines

This furnishes a complete vertical line from which mills may meet their needs. Standout feature of these four new pumps is their engineering thoroughness. Shartle is ready to furnish further details on any vertical pumping condition.

To Construct New Water Supply Plant

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., November 24, 1941—Permission has been granted the city of Peshtigo, Wis., to construct a water utility plant at a cost of $80,000, following approval given by the taxpayers in a referendum.

To Represent Asten-Hill on Coast

Leonard McMaster has left the direct employ of the Asten-Hill Mfg Company to represent them and other concerns on the West Coast. He is well known among the mills in that territory, for he made more than twenty trips to the Coast for Asten-Hill in the past few years; in fact, he spent a good part of his time out there with Walter S. Hudges, the former

LEONARD MCMASTER

Asten-Hill Coast representative, who died recently as a result of an unfortunate automobile accident. Mr. McMaster will maintain offices in the Pacific Building, Portland, Ore.

G. T. Henderson Goes With OPM

SANDUSKY, Ohio, November 24, 1941—George T. Henderson, director of the package laboratory of The Hinde & Dauch Paper Company, has been appointed assistant to the head of the Container Branch of OPM and assumed the duties November 1.

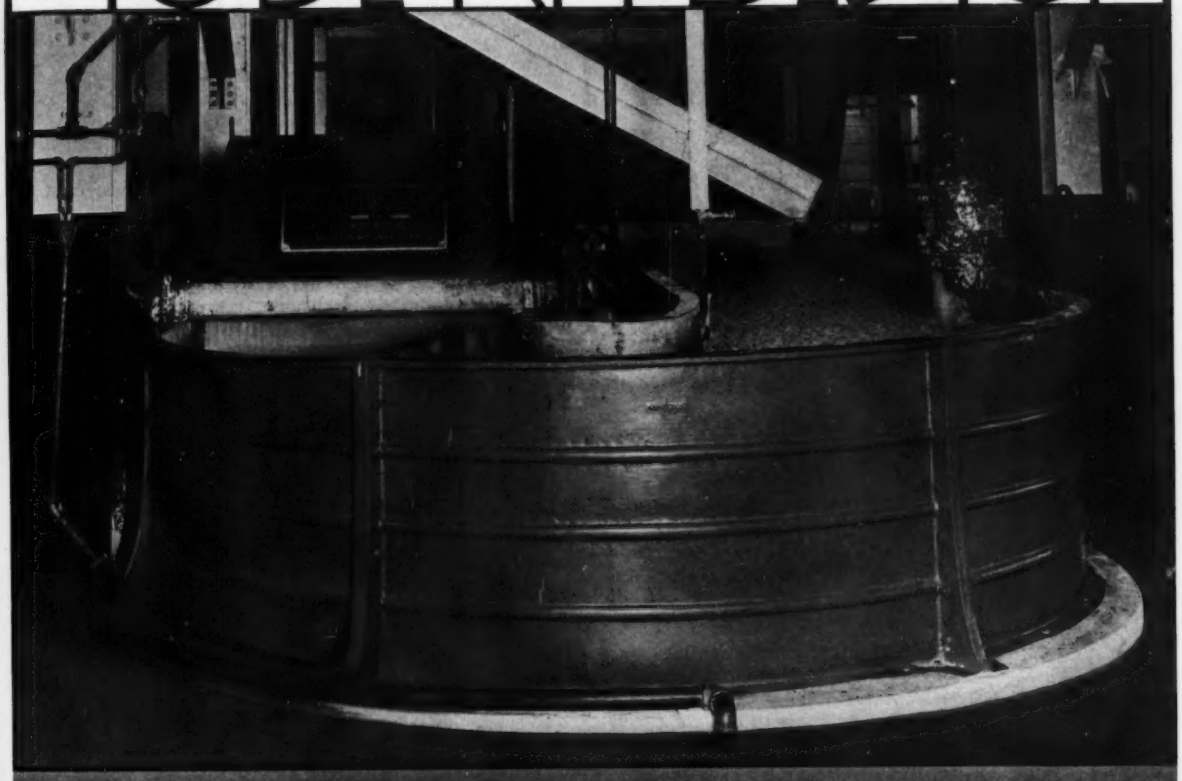
Mr. Henderson, who has been with Hinde & Dauch for the past six years, has been granted leave of absence by the company for the duration of the emergency and will return upon completion of his work in Washington.

He has had a wide and varied experience in the packaging industry which should prove invaluable to OPM, having spent two years as engineer with Container Testing Laboratories, New York, and four years as consultant for a group of Scandinavian pulp producers in the development of the use of corrugated boxes in Europe. This led to the establishment of railroad classifications, new board mills, and box factories throughout the European countries.

The work was later turned over to a Swedish engineer trained under Henderson who returned to this country to join Hinde & Dauch to develop and promote the use of corrugated boxes in the textile industry in the south. He later took over the sales in the Carolinas and in 1937 was appointed director of the Sandusky Package Laboratory.

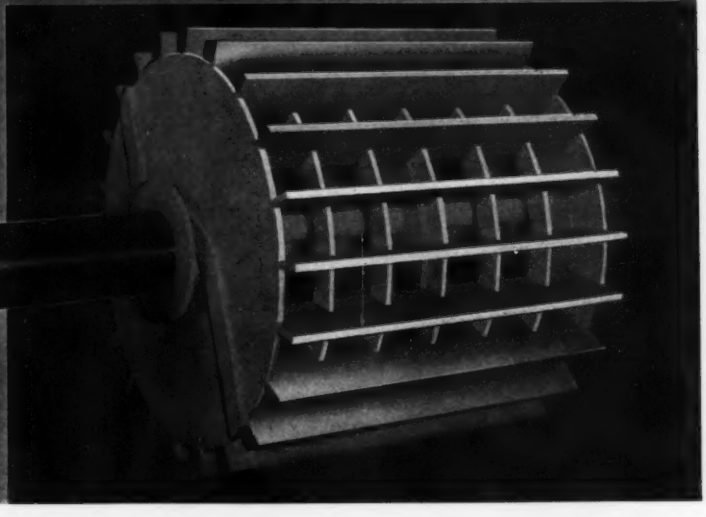
Mr. Henderson who has a B. S. degree in mechanical engineering is a member of the American Society of Mechanical Engineers.

MODERN DESIGN



THE VALLEY BROKE BEATER

AND
BREAKER
ROLL



Canadian Agents:
Pulp & Paper Mill Acc., Ltd.
Dominion Square Building,
Montreal, Quebec, Canada

VALLEY
Iron Works Company
Plant: Appleton, Wisconsin

Eastern Representative:
Harry Bennett, 12 McKinley St.
Bronxville, Westchester Co.
N. Y.

Speed Regulating Device Outstanding On New Paper-Making Machine

A speed-regulating device that makes for responsive, accurate control of speed with elimination of several pieces of heretofore necessary equipment will be an outstanding feature of a paper-making machine drive now being built by the General Electric Company for a machine to be used at the W. C. Hamilton & Sons plant, Miquon, Pa.

The speed regulator makes use of an industrial type electronic amplifier in combination with an amplidyne control, which will result in unusually accurate control because of the absence of inertia and because of the inherent sensitivity of the combination. The number of speed changes will thus be negligible, and paper breaks minimized.

Introduces Unusual Simplicity

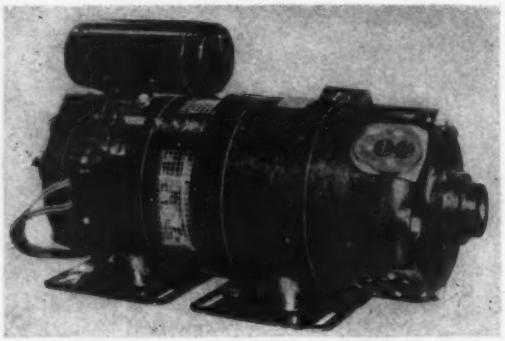
The amplidyne control introduces unusual simplicity into the speed-regulating equipment, eliminating apparatus necessary with other types of control. Maintenance is expected to be appreciably reduced as a result of this reduction of the number of parts.

The paper-making machine will have a speed range of 40 to 380 feet per minute, and will be used mainly in the manufacture of book and specialties.

In the paper industry, amplidyne control has been applied to paper machines with the result that both light and heavy grades of paper can be made on the same machine uniformly and with reduced waste. It is also being used for the control of super calenders, wet-end drives on cylinder machines, side register on winders, and on bag machines, in addition to being used in conjunction with photoelectric equipment to maintain exact register of paper moving rapidly through re-winding machines.

A Form of Control

Although, at first glance, it looks like an electric motor or generator, the amplidyne generator is, to all intents and purposes, a control device. It is in a sense similar to radio amplifier tubes. Just as certain vacuum tubes, through the control of minute amounts of electric power, can control the flow of large amounts of power in other electric equipment, so the amplidyne generator can amplify, hundreds or even thousands of times, the variations in the power impressed upon it. Thus, when the device is used as a means of excitation for large generating apparatus, one watt of electric power can be utilized to control many kilowatts.



Typical 500-Watt Amplidyne Generator

There is no perceptible time lag between adjustment of the amplidyne generator control by an operator and response of its output, since the amplidyne generator responds almost instantaneously to changes in power input.

The use of amplifiers is common in radio but the term "amplification" has seldom been used in power engineering. Strictly speaking, it might be said that a radio amplifier is only a form of control, because a fresh source of power is always tapped, and the function of the amplifier is to control this power so as to reproduce the changes of energy flow at a higher power level. By "amplification" something more specific is meant than when the term "control" is used. An amplifier must give an accurate reproduction of both intensity and time intervals. The radio-frequency amplifier involves a time interval of less than a millionth of a second. The only device known that will respond in such a short time is the high-vacuum electron tube. In power circuits, on the other hand, the time element is seldom less than a tenth of a second.

The Work of Development

When it became apparent that amplifiers were needed in power engineering, electrical engineers naturally turned to the vacuum tube. It was found that the high-vacuum tube used in radio did not lend itself to power circuits as well as the mercury-vapor and gas-filled tube known as the thyratron. A number of successful applications were made with thyratron amplifiers, such as the precision control of a large boring mill and high-speed excitation of synchronous condensers. It became evident, however, that an amplifier of a more familiar construction was needed for factory and power-station use. This need led to the development of the dynamoelectric amplifier, or amplidyne generator, which is a two-stage amplifier incorporated in the structure of a single d-c generator.

The amplidyne generator with its two stages of amplification is analogous to a d-c generator coupled to, and excited from a direct-current exciter. The first stage of amplification is between the input to the field of the exciter and the output from its armature. The second stage is between the input to the generator field and the power supplied by the generator. The amplidyne generator has a higher speed of response and a larger amplification than the generator and exciter mentioned.

The amplidyne generator consists essentially of a conventional-direct current generator with its output brushes short-circuited to produce a powerful magnetizing field in the armature at right angles to the main

TIGHTENING UP ON CORROSION

Now, when production must be kept flowing without interruption due to pipe line shutdown, when product standards specify chemical purity, when costs must be held to a minimum, PYREX Pipe Lines are proving their true value.

In view of present demands, just consider these qualities of PYREX brand Industrial Glass. Remarkable resistance to all acids and alkalies in solution (except HF). Resistance to thermal shock that permits flushing with hot water, hot acids or steam. Transparency that reveals the condition of both piping and contents throughout pipe lines. Freedom from pitting and resistance to scaling that add to long life and mean uninterrupted service at low maintenance cost.

These are the reasons why, today, PYREX Piping is finding increased application throughout industry—why you should seriously consider PYREX Piping for your pipe lines. Corning Engineers will gladly cooperate in the solution of your piping problems.

"PYREX" is a registered trade-mark and indicates manufacture by Corning Glass Works.

CORNING
Glass Works
Corning, New York

Pyrex Industrial Glass

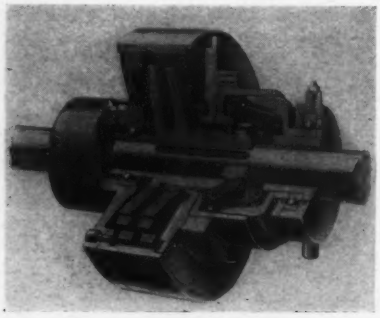
field. This cross magnetization produces a voltage between a second set of brushes located at right angles to the short-circuited brushes, from which the amplified output is supplied. The first stage of amplification is between the main field and the short-circuited brushes, corresponding to the exciter, and the second stage of amplification, corresponding to the generator, is between the short-circuited brushes and the brushes at right angles. Each of these stages can have an amplification of 100 to 1, which produces an over-all amplification of 10,000 to 1.

Applied to Other Industrial Processes

In addition to the applications mentioned in the paper industry, the amplidyne generator system has been successfully applied to many other industrial processes and although the field of application has expanded rapidly there are still many other uses to which this system can profitably be put. The development of the amplidyne generator to its present high degree of usefulness is a direct result of General Electric research and engineering.

A New Clutch

Recently announced by T. B. Wood's Sons Company, Chambersburg, Pa., the Torque-Master Friction Clutch combines every advantage known today in clutch design.



TORQUE-MASTER FRICTION CLUTCH

Available in single and multiple disc types and in a wide range of sizes, the Torque-Master is designed for the heaviest type of work, impact and pulsating loads. With all parts totally enclosed, it combines safety at high speed with inherent dependability under all operating conditions.

As indicated in the illustration, friction plates are of gear tooth design, while the entire operating mechanism is simple, sturdy and consists of only a few moving parts. All adjustment for wear or load conditions is made with one knurled hand adjusting ring—no special tools needed.

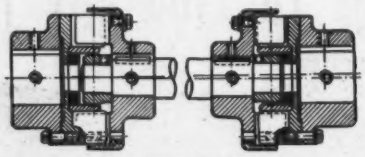
New Partnership Announced

A new partnership known as the Livingston & Southard Paper Company, with temporary offices at 17 Battery Place, New York, has been announced.

The concern will have the full support of B. S. Livingston and H. W. Southard, members of the firm of Livingston & Southard, Inc., 17 Battery Place, New York. The newly organized concern will specialize in the export business job lots and seconds or off-grades of paper.

Floating Shaft Coupling

A feature of the floating shaft flexible coupling manufactured by the Lovejoy Flexible Coupling Company, 5001-5009 West Lake street, Chicago, Ill., is that the floating shaft is independent. It is applicable to either horizonal or vertical drives and is recommended for longer distance drives, where space between the driver and driven units cannot be successfully handled by standard couplings, and especially where there is excessive misalignment.



OPERATING ASSEMBLY

The Lovejoy floating shaft is supported in fixed bearings and is entirely independent of power transmission elements, which are thus entirely unaffected by forces generated by the floating shaft itself, and operate entirely in transmitting power. Concentricity of ends of fixed shafts is permanently assured, thus entirely eliminating whipping of ends of shaft at any speed. The coupling is quickly dissembled when required by merely reversing three to five driving bolts. This reversal automatically pulls coupling bodies away from their adapters, creating a gap which permits collapsed center assembly to be lifted out. This is accomplished without disturbance of cushions or connected units.

Lovejoy "L-R Type HKQ" couplings are made in standard sizes, with bores from 1½ to 8½ inches, 7 to 800 h.p. at 100 r.p.m., for various distances between shafts, and for handling misalignment. Three types of cushions are used for various applications. Either of the coupling bodies mounted on fixed shafts, may be used as a sheave, or part of a sheave, for V-belt drive. Suitable cushions prevent chatter caused by endwise impact of floating shaft against the fixed shafts, and free oscillation of the floating shaft in vertical or horizontal positions is assured.

Flintkote Mill at Full Capacity

The new insulation board mill of the Flintkote Company at Meridian, Miss., was completed late in 1940. Ground was broken on June 15, 1940. The first trial run was made six months later on December 24 and the mill has been in full capacity operation since that time.

The design and construction of the Meridian plant was the result of collaboration by George J. Pecora, resident manager, W. J. Van Akin, assistant general manufacturing manager of the Flintkote Company, and the Rust Engineering Company.

The Meridian plant is located on a 150-acre site, four miles south of Meridian, Miss. It is served by four railroads. The plant is one-quarter of a mile in length and contains over 100 carloads of precision machinery.

An ample supply of wood pulp is assured by the 1,000,000 acres of timber located within a radius of 30 miles of the mill.

The main buildings of the mill, house the stock preparation, forming machine, board drying, fabricating equipment and storage space. Additional facilities were later added to increase the productive capacity of the mill by 50%.

50,000th SERVING OF THE JOHNSON JOINT

ONE OF THE FINEST DISHES EVER SET BEFORE AMERICAN INDUSTRY

INDUSTRY got its first taste of the Johnson Rotary Pressure Joint less than ten years ago. In the brief interval since that time Johnson Joints have spread throughout industry—replacing stuffing boxes, steam fits and similar pressure joints on all types of machines where steam or liquids under pressure must be admitted to rotating rolls or drums. Today we are proud to announce completion of Johnson Joint No. 50,000.

This rapid acceptance is simply one more proof that American Industry—always quick to recognize and adopt new ways to do the old tasks better—has found that the Johnson Joint *is* such a better way—that it offers important savings and benefits when compared with the old style stuffing boxes and steam fits. It never needs to be oiled, adjusted or repacked. It absorbs misalignment, both lateral and angular, without loss of operating efficiency. More than that, it offers a simpler, neater way to provide efficiency-boosting syphon drainage of rolls and cans.

There is nothing else like the Johnson Joint —nothing which helps more to keep maintenance costs down, production figures up. Today it is more in demand than ever, and we confidently expect that this 50,000 mark will be just the first of many milestones.

Complete details and specifications sent on request

Products of The Johnson Corporation

828 WOOD STREET, THREE RIVERS, MICHIGAN

N. P. A. Holds Annual Meeting

The annual meeting of the National Paperboard Association was held at the Waldorf-Astoria Hotel, New York on November 12 and 13. The attendance was large and represented 84% of the tonnage of the members. The following officers were elected:

President, Charles E. Nelson, president Mac Sim Bar Paper Company, Ostego, Mich.; vice-president, George E. Dyke, president, Robert Gair Company, Inc., New York; executive manager, Frederick G. Becker, 40 East 41 street, New York; secretary-treasurer, H. S. Adler, 80 East Jackson Boulevard, Chicago, Ill.

David A. Sealey continues as secretary of the Eastern Division with office in New York. Grafton Whiting continues as statistician and Alvin A. Newburg as assistant statistician with headquarters in Chicago.

The meeting provided ample opportunity for a discussion of industry problems. President Charles E. Nelson, in his report to the members stated that the paper board industry during the past year has been taxed to produce the largest quantity of board ever required in any previous period. "Just how we have seen our duty and how well we have done it." Mr. Nelson said, "is evidenced by the fact that paper board production during the first ten months of 1941 is 23.7% above 1940 and the average tons per week this year have been 149,000, compared with 120,400 tons in the same period of 1940."

Reports were submitted showing in detail how members of the association are cooperating in the national defense program. The subject of supplying paper board for defense needs had a prominent place in the sessions. It was reported that vast quantities of foodstuffs packed in paper board boxes are being shipped to England and other overseas destinations. It was also pointed out that the demands for paper board for fiber boxes as containers for foods, clothing, supply items, ammunition, etc., for the armed forces, continues to increase.

The major topic under discussion was just how the paper board industry can best use its facilities and available raw materials, in supplying the urgent needs of the government and at the same time take care of important and necessary civilian requirements.

The list of directors elected by the respective groups and by the membership at large is as follows:

Eastern Container Board: Anthony Desideric, Clifton Paper Board Company, Clifton, N. J.; George E. Dyke, Robert Gair Company, Inc., New York; Alan G. Goldsmith, Mead Corporation, Chillicothe, Ohio.

Southern Container Board: Alexander Calder. Union Bag and Paper Corporation, New York; R. J. Cullen, International Paper Company, New York; Fred E. Hummel, Hummel-Ross Fibre Corporation, Hopewell, Va.; Roger L. Main, St. Joe Paper Company, Jacksonvile, Fla.; Elis Olsson, The Chesapeake Corp., West Point, Va.; S. M. Phelan, Jr., West Virginia Pulp and Paper Company, New York.

Eastern Boxboard: W. G. Latham, Fort Orange Paper Company, Castleton on Hudson, N. Y.; Geo. W. Mabee, National Folding Box Company, New Haven, Conn.; W. G. Shortess, Federal Paper Board Company, Bogota, N. J.

Western Boxboard: E. T. Gardner, Gardner-Richardson Company, Middletown, Ohio; F. M. Lebold, Morris Paper Mills, Chicago, Ill.; W. I. Osborne, Jr., Cornell Wood Products Company, Chicago, Ill.

Corrugating Materials: C. D. Altick, Terre Haute Paper Company, Dayton, Ohio; H. T. Cherry, Central Fibre Products Company, Tama, Iowa; Sidney Froham, Hinde & Dauch Paper Company, Sandusky, Ohio.

Pacific Coast: John W. Kieckhefer, Kieckhefer Container Company, Milwaukee, Wis.; D. H. Patterson, Jr., Fibreboard Products, Inc., San Francisco, Cal.; C. J. Schoo, Longview Fibre Company, Springfield, Mass.

Lightweight Chipboard and Bogus: H. J. Finder, Prairie State Paper Mills, Joilet, Ill.; J. E. Kieffer, Kieffer Paper Mills, Ewing, Ind.; H. D. Schmidt, Schmidt & Ault Paper Company, York, Pa.

Directors at Large Elected by Membership: W. J. Alford, Jr., Continental Paper Company, Ridgefield Park, N. J.; Jos. S. Miller, New Haven Pulp and Board Company, New Haven, Conn.; C. E. Nelson, Mac Sim Bar Paper Company, Otsego, Mich.; G. G. Otto, Alton Box Board Company, Alton, Ill.

Sangamon to Add to Machine Room

APPLETON, Wis., November 24, 1941—Enlargement will soon be started by the Sangamon Paper Mills, Kaukauna, Wis., of the machine room. Plans have been completed for an addition 48 by 60 feet to the west end of the present mill, calling for concrete block construction, with steel frame work.

Contracts for the construction will soon be let, according to T. H. Russell, superintendent. When completed, the company plans to lengthen its two machines so as to increase production. Warehouse capacity also will be increased 50 per cent. In the near future a machine shop also is to be added.

The present mill building is 60 by 250 feet in size and houses two machines, 62- and 72-inch. They are producing corrugated and wrapping papers entirely from waste. Water power drives have been discontinued and motor drives are being used entirely.

Operations were started by the Sangamon Paper Company on April 1 of this year, after purchasing the former Patten Paper Company mill from the City of Kaukauna in May, 1939. Months were spent remodelling and reconditioning. Only one machine was used until October 22, when the second was started. The number of employees has been increased from 28 in April to 50 at the present time. The owners are Sam and Abe Cohen of Chicago.

A. M. Kinney Erects Mill in Columbia

A. M. Kinney, Inc., 1301 Enquirer Bldg., Cincinnati, Ohio, have been retained as consulting engineers to erect a new kraft mill for Industria Papelera Colombiana "Zipa" Ltda., Barranquilla, Columbia, of which Hernando Ruiz Quijano is general manager. The plant will have a capacity of 20 to 25 tons per day of kraft paper. A. M. Kinney, Inc. will buy all the machinery for the plant in this country and is at present receiving bids from representative manufacturers of such machinery and equipment.

To Erect Boiler Plant at Hartford City

A. M. Kinney, Inc., 1301 Enquirer Bldg., Cincinnati, Ohio, has been awarded the contract to erect an addition to the boiler plant of the Hartford City Paper Company at Hartford City, Ind.

I. P. Spends $50,000,000 on Plants

The International Paper Company spent nearly $50 million on plants and properties other than for acquisition of woodlands in the five years ended December 31, 1940, and raised its paper and pulp making capacity by nearly 50% in that period according to the *Wall Street Journal*. The actual amount spent was $49,882,797, according to the company's prospectus covering 1,387,748 shares of common stock issuable on exercise of stock purchase warrants.

On December 31, 1935 its total pulp and paper making capacity was 1,881,920 tons. The current capacity is 2,761,275 tons.

The increase has come principally in facilities for the production of kraft paper and board. On December 31, 1935, the company had capacity to make 472,350 tons of kraft paper and board, and the present capacity is approximately 1,261,275 tons a year, based on 335 day operation of the machines.

Other changes are now being made which will add still further to the company's capacity.

The greatest expansion is taking place at the company's mill at Georgetown, S. C. Last May work began on the installation of a third machine at the mill which will add about 500 tons to daily kraft container board capacity, together with additional pulp and power facilities to support the additional board production. International is also building a box plant with an annual capacity of about 30,000 tons at Georgetown adjoining the kraft board mill. It is expected that this box plant will come into production sometime in 1942, using container board produced by the Georgetown mill. The present capacity of the Georgetown mill is 750 tons daily.

In 1937 and 1938, International acquired jute board mills at Spring Garden, Pa., Hartford City, Ind., Rockford, Ill. and Cincinnati, Ohio. As a result of increasing demand for container board, the Spring Garden and Hartford City mills were brought into production in 1941 and the Rockford and Cincinnati mills have recently been leased to container manufacturers for operation by them.

Additions and changes are being made to convert the company's mill at Bastrop, Louisiana, so that it can make either bleached kraft or regular kraft up to its entire installed capacity. The mill will then be interchangeable according to demand.

Changes have been made at the Three Rivers mill of the Canadian International Paper Company, a subsidiary, which have enabled four of the eight paper machines at the mill to produce wood-pulp board for sale to corrugated container manufacturers in the United States. To an extent, this wood pulp board will be used in place of light weight kraft board. "It is unlikely that this business will continue after the war is ended" the company says.

Changes which are now being made in the company's mill at Mobile, Ala., will increase its present kraft paper capacity to about 480 tons daily from 400 tons.

FINANCIAL NEWS

New York Stock Exchange

High, Low and Last for Week Ending November 26, 1941

	High	Low	Last
A. P. W.	1½	1½	1½
Armstrong Cork Co.	25¼	24⅛	24½
Celotex Corp.	7¼	6⅞	7
Celotex Corp., pf.	68	66½	68
Certain-Teed Products Corp.	2¾	2½	2½
Certain-Teed Products Corp., pf.	32⅝	30	30
Champion Paper & Fibre Co.	18½	17¾	18⅜
Champion Paper & Fibre Co., pf.	100½	98⅝	100½
Congoleum-Nairn Co.	16¼	15⅜	16
Container Corp. of America	13¾	13¼	13⅜
Continental Diamond Fibre Co.	8¾	8⅝	8¾
Crown-Zellerbach Co.	12¼	11⅝	11¾
Crown-Zellerbach Co., pf.	89¼	87¾	87¾
Flintkote Co.	11⅝	11	11¼
Robert Gair	2½	2⅜	2⅜
Robert Gair, pf.	11⅞	11⅜	11⅞
International Paper & Power	17⅛	16⅜	16½
International Paper & Power, pf.	59⅛	56¾	56¾
Johns-Manville Corp.	59¼	57½	58½
Johns-Manville Corp., pf.	125½	125½	125½
Kimberly Clark Corp.	30	29½	30
MacAndrews & Forbes	21½	21¼	21¼
MacAndrews & Forbes, pf.	133½	133½	133½
Masonite Corp.	25½	24¾	25
Mead Corp.	7¼	6⅝	6¾
Mead Corp., pf.	....	....	....
Paraffine Companies, Inc.	26	25⅜	26
Paraffine Companies, Inc., pf.	....	....	....
Rayonier, Inc.	12	11	11
Rayonier, Inc., pf.	25¾	25¾	25¾
Ruberoid Co.	21	20	20¼
Scott Paper Co.	36	34½	36
Scott Paper Co., pf.	115	110½	115
Sutherland Paper Co.	17⅝	16¾	16⅞
Union Bag & Paper Corp.	9⅛	8⅝	8⅝
United Paperboard Co.	3⅞	3¾	3¾
U. S. Gypsum Co.	49¾	47½	47½
U. S. Gypsum Co., pf.	177½	177½	177½
West Virginia Pulp & Paper Co.	18	17¾	17¾

New York Curb Exchange

High, Low and Last for Week Ending November 26, 1941

	High	Low	Last
American Box Board Co.	4¼	3¾	3¾
Brown Co., pf.	24	23½	23½
Great Northern Paper	....	....	....
Hummel-Ross Fibre Corp.	5¼	5¼	5¼
National Container Corp.	10½	10½	10½
St. Regis Paper Co.	2⅛	1⅞	1⅞
St. Regis Paper Co., pf.	119	119	119
Taggart Corp.	2½	2⅜	2½

West Virginia Nets $2.97

Operating at a high production ratio throughout almost all of the last fiscal year of West Virginia Pulp and Paper Company reports a substantial increase in profits over the preceding year.

In nine months ended July 31 the company had net profit of $3,382,624, or $2.97 a common share, against $2,497,463, or $1.99 a share, in like period of preceding year.

With the rate of operations higher in the final months than during the first two quarters, it appears likely that the last quarter of the year will produce earnings somewhat better than the average of $1,127,541 per quarter for the three preceding quarters. This would yield a net profit for the full year of $4,500,000 or better, equal to about $4 a share on the common.

Except where suspensions have been made necessary by repairs or changes in equipment, the company's mills have been running 24 hours a day seven days a week for many months. Additional digesting equipment is being installed at one mill which will increase the pulp capacity of that mill by about 30%. When heavy grades of paper are being produced this will increase the over-all capacity of the mill.

In the year just ended West Virginia had the benefit of a lag in the effect of the income tax on earnings. Because its fiscal year started before Jan. 1, 1941, it paid taxes during the last fiscal year at the 1940 rate. The 1941 rates, however, are applying on earnings since Nov. 1 this year which would tend to limit further profits gains.

St. Lawrence Declares Dividend

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., November 24, 1941—Directors of the St. Lawrence Paper Mills Company, Limited, have declared a regular quarterly preferred dividend of 75 cents per share, payable January 15, of record January 2 and, in addition, have declared a further dividend of $1.50 per share, payable December 22, of record December 10. This brings dividend payments in respect of the current fiscal year to $3.75 per share and, after these payments, arrears will amount to $59 per share.

At the same time, directors of St. Lawrence Corporation declared the regular quarterly dividend of 25 cents per share on the "A" preferred stock, payable January 15, of record January 2 and, in addition a dividend of $1.00 on account of arrears, payable December 22, of record December 10. This brings dividend payments in respect to the current fiscal year to $1.75 per share and, after these payments, arrears will amount to $15.50 per share.

Champion Fibre Votes Bond Issue

Champion Paper and Fibre Company stockholders on November 18, approved amendments to permit proposed sale of $8,500,000 of 3½% first mortgage bonds and 40,000 shares of cumulative convertible preferred stock.

Part of the proceeds would be used to redeem outstanding 4¾% debentures, and the remainder for capital purposes. Common stock authorization was increased from 556,000 shares to 756,000 shares to provide for conversion of the new preferred stock. Directors will fix the conversion prices.

The underwriting syndicate will be headed by W. E. Hutton & Co. and Goldman Sachs & Co., New York.

Sutherland Votes Dividend

The Sutherland Paper Company has declared an extra dividend of 5 cents a share and a quarterly dividend of 30 cents a share on the common stock, both payable December 15 to stock of record November 24. Preceding payment was 30 cents a share made on September 15, 1941.

Paper Securities Strong

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., November 24, 1941—The strength of the paper issues on the stock market, particularly during periods of relative firmness, has attracted the attention of investors, and there has lately been considerable trading in these securities.

Fraser issues, the common and voting trust cer-

tificates, have been particularly active and strong, attributed to the improved position of this company, which is in the pulp and special paper field, as demand for such products continued to mount to record levels.

Price Bros., among the newsprints, also has been a firm spot. Price has tended to lag behind some of the other newsprint issues this year, but at present the company is engaged in production of Nine Point paper which has considerably added to sales revenues, and profits.

Scott Declares Dividends

Directors of the Scott Paper Company have declared an extra common dividend of 20 cents per share, in addition to the regular quarterly dividend of 45 cents, both payable December 15 to stock of record December 2.

Also ordered was the regular quarterly dividend of $1.12½ per share on the company's $4.50 cumulative preferred shares and the regular quarterly dividend of $1 a share on $4 cumulative preferred, both payable February 1, to stock of record January 20.

Kimberly-Clark to Pay $1.25

The directors of the Kimberly-Clark Corporation have authorized an extra dividend of $1.25 on the common stock, payable on December 22 to holders of record of December 12. Dividends this year total $2.25, against $2 for 1940. Directors also declared the regular quarterly dividend of 25 cents a common share, payable on January 2 to holders of record of December 12.

Lily-Tulip Cup Votes Dividend

The Lily-Tulip Cup Corporation has declared a year-end dividend of 30 cents and a quarterly dividend of 30 cents on the common stock, both payable December 15 to stock of record December 1. Previous payment was 30 cents a share made on September 15, 1941.

Parker-Young Earnings Up

The Parker-Young Company for the year to August 31, reports a net income of $216,527, equal, after preferred dividends, to $15.92 each on 11,740 shares, compared with $90,489, or $5.18 a common share in previous year; Net sales, $4,115,206, against $3,430,756.

Nekoosa-Edwards Nets $6.85

The Nekoosa-Edwards Paper Company for the nine months to September 30, reports a net profit of $521,100, equal to $8.27 each on 63,000 shares, against $431,331, or $6.85 a share, last year; net sales, $7,325,312, against $5,794,363.

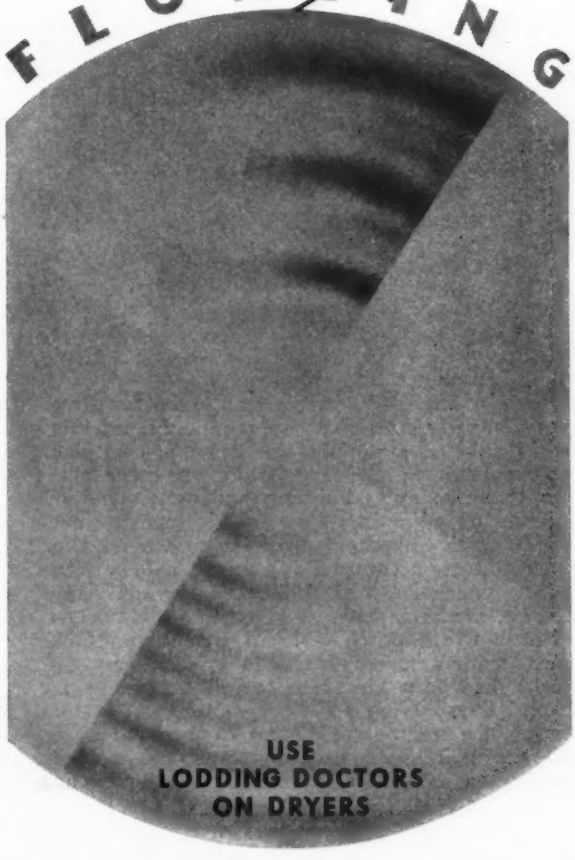
Hinde & Dauch Votes Dividend

The Hinde & Dauch Paper Company of Canada, Ltd., has declared a dividend of 25 cents a share on the common stock, payable December 20 to stock of record December 10. Previous payments was 12½ cents a share made on October 1, 1941.

Blades Changed
Like Opening a Drawer

The patented "Floating Blade Principle" of the Lodding Doctor eliminates all bolting, clamping, or otherwise permanently mounting the blade, thus it does not actually become an integral part of the holder. Floating makes the blade a free, independent unit, safely secured in the holder in a simple manner which permits it to be slid out endwise in a few minutes' time. . . . May we send one of our engineers, or a copy of our new bulletin describing the Perforated Blade Doctor for dry positions? Write either the Lodding Engineering Corporation, Worcester, Massachusetts, or the W. E. Greene Corporation, Woolworth Building, New York.

LODDING
FOR EVERY *Doctors* POSITION
FLOATING



CONSTRUCTION NEWS

Lockland, Ohio—The Fox Paper Company, manufacturer of kraft paper products, paper board specialties, etc., has approved plans for new one-story addition, to be used for storage and distribution. Work on superstructure is being placed under way. General erection contract has been let to Joseph Messingschlager, Carthage avenue, Norwood, Ohio. No estimate of cost has been announced.

Appleton, Wis.—The Appleton Coated Paper Company, North Mead street, manufacturer of coated book, bond papers, cover stocks, etc., has awarded general contract to Fred Hoeppner Sons, Inc., 1203 North Union street, Appleton, for proposed new addition to mill, recently noted in these columns, and work will be placed under way at once. It will be one-story and used for general operating service.

Raritan, N. J.—The Seeley Tube and Box Company, 360 Thomas street, Newark, N. J., manufacturer of paper boxes and containers, paper tubing, etc., has arranged for lease of part of property of the Raritan Mills, Inc., Raritan, totaling about 100,000 square feet of floor space, and will occupy for branch storage and distributing plant. Company is specializing in the production of containers for shells for the Government, and will use the new quarters for distribution to Federal arsenals and loading plants in this part of State. This is the third such expansion of the company in recent weeks. As previously noted in these columns, entire former plant of the Stursneger Company, Chester, N. J., has been taken over for a new factory branch; and two one-story buildings of the former Granite Textile Mills, Montville, N. J., have been leased for similar occupancy.

Rochester, N. Y.—The Haloid Company, 9 Haloid street, manufacturer of processed photographic papers and other special paper stocks, has awarded general contract to John Luther & Sons Company, 87 Stillson street, for proposed new addition to mill, and superstructure will be placed under way at early date. It will be one-story, about 40 x 250 feet, reported to cost over $85,000, with equipment. S. Firestone, 59 South avenue, Rochester, is architect and engineer.

Detroit, Mich.—The American Asbestos Products Company, 5701 Davison avenue, manufacturer of insulation materials, etc., has approved plans for expansion in plant, including one-story addition to an existing building and new one-story building on adjoining site. Cost is reported over $50,000, with equipment. Bids have been asked on general erection contract and award will be made soon. Lyndon & Smith, 13700 Woodward avenue, Detroit, are architects.

Battle Creek, Mich.—Michigan Carton Company, manufacturer of manila and other paper stocks, has been forced to curtail operations for several days owing to shortage of waste paper stock. The mill is giving employment to about 700 persons in different departments, and has been running on a 24-hour, seven-day week production schedule since last July. Orders on hand insure continuance of this basis of output, with scrap paper stock procurable.

Phillipsdale, R. I.—Bird & Son, Inc., East Walpole, Mass., manufacturer of roofing and building papers, insulating paper, wall board, etc., has awarded general contract to Vappi & Co., Inc., 240 Sidney street, Cambridge, Mass., for proposed new addition to branch mill at Phillipsdale, previously referred to in these columns, and work on structure will be placed under way at once. It will be one-story, about 150 x 360 feet, to be used in part for expansion in dryer department and other production divisions, with portion of unit to be used for storage and distribution. Cost is reported close to $100,000, including equipment. Ganteaume & McMullen, 99 Chauncy street, Boston, Mass., are consulting engineers.

Salem, Ore.—The Oregon Pulp and Paper Company, manufacturer of bond and other writing paper, greaseproof papers, etc., is pushing construction of new three-story building, 20 x 200 feet, at 315 South Commercial street, and expects to have the structure ready for occupancy at early date. It will be used largely for storage and distribution service, as previously stated in these columns, and will represent an investment reported at close to $100,000, with equipment. Vieske & Hannaman, 1440 South Thirteenth street, Salem, have the general erection contract.

Merritton, Ont.—The Alliance Paper Mills, Ltd., manufacturer of book, bond, glassine and other papers, are said to have awarded further contracts to the Redfern Construction Company, Ltd., 36 Toronto street, Toronto, Ont., for other expansion and improvements in local mills, in addition to new addition to sulphite pulp mill, lately noted in these columns. Entire project is reported to cost in excess of $200,000, including equipment. J. Charles Day, 630 Dorchester street West, Montreal, Que., is consulting engineer for company, which is affiliated with the Howard Smith Paper Mills., Ltd., 407 McGill street, Montreal.

New Companies

Long Island City, New York, N. Y.—The Freeman Paper Company, Inc., has been incorporated with capital of $10,000, to deal in paper goods of various kinds, including paper bags and containers. New company is represented by Jacob Mishler, 31-16 Steinway street, Long Island City, attorney.

Appleton, Wis.—The Merrill Paper Company has been organized to manufacture and deal in paper products of various kinds. The incorporators include A. T. Brenner, W. E. Terwilliger and Elmer R. Honkamp, all of Appleton.

Pomfret, N. Y.—Soap-N-Towel, Inc., Pomfret, near Portland, N. Y., has been organized with capital of $20,000 and 5000 shares of common stock, no par value, to operate a local plant for the manufacture of paper towels and allied paper goods. New company is represented by Arthur B. Towne, 126 East Fourth street, Dunkirk, N. Y., attorney.

Expansion Program at St. Regis Mill

The St. Regis Paper Company's Kraft Pulp Division at Tacoma, Wash., operates a thoroughly modern bleached kraft mill. This plant has been expanded through successive additions from a capacity of 60,000 tons in 1936 to a capacity of 100,000 tons annually upon the completion of the present construction program the end of this year.

The product is manufactured from 100% Western white wood which is supplied to the mill in the form of saw logs. The logs are cut up in a standard sawmill, barked, and thoroughly cleaned in a processing department before the wood enters the chippers. The wood comes to the chippers in sawn squares, or side cuts about twelve feet long.

Mill Equipped with Six Digesters

There are six digesters with rapid circulating systems which insure a thorough circulation of the liquor. The pulp is riffled and screened by the latest up-to-date flat screens. The pulp, after blending, enters the bleach plant.

Two Flakt Fourdrinier Dryers Installed

In the bleach plant the pulp goes through a seven stage bleaching system and is blended again in a large blending tank before entering the dryers. The dryers consist of two latest type Fourdrinier Flakt dryers where the pulp sheet is conveyed after formation on the wire through a drying chamber at slow speed under low temperature. These dryers are under temperature control which insures a minimum of deterioration in the drying process.

Chemical Plant Completely Modern

The chemical plant of the mill consists of the most modern recovery units employed in the industry, to insure, together with the causticizing and liquor making department of latest equipment, maximum efficiency in this department.

To Produce Bleached and Unbleached Pulp

The processing layout of the mill permits production of full bleached and unbleached kraft at the same time. While the plant is essentially built to produce 100% full bleached kraft, the operation can be changed at any time to produce both grades of pulp simultaneously.

Approximately 20% of the output is used by the company's own mills in Northern New York; 30% for export to all of the world markets; 50% is sold in the open markets of the United States where the company enjoys an excellent distribution for its high grade "Tacoma Kraft."

Agree to Lower Kraft Paper Prices

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., November 26, 1941—Leon Henderson, Price Administrator, has announced that more than one hundred representative wholesalers of paper products have individually indicated their willingness to abide by requests of OPA for sharp reductions in present jobber mark-ups in prices of kraft wrapping paper.

BRASSERT AUTOMATIC SELF-CLEANING STRAINER FOR WATER PROBLEMS

will immunize you against "headaches" resulting from clogged nozzles, plugged pipes, obstructed screens, over-burdened filters, excessive erosion of equipment and general inefficiency of processes caused by presence of suspended solid particles in liquids.

These strainers will remove these solid particles in a continuous, automatic and self cleaning manner and make them available for disposal or reclamation.

ADVANTAGES OF BRASSERT STRAINER

- It is self-contained on one base with all moving parts enclosed.
- It requires a minimum amount of space and a minimum cost of installation.
- It requires practically no attention and consumes very little power to operate.
- It can be installed in or out of doors.
- The screening media consists of glazed perforated porcelain, reinforced stainless steel screen discs or stainless steel screen cone discs.
- The screening discs can be changed from one size to another, or inspection made, through the hand holes in the side of the housing, without dismantling or readjusting the machine.

Investigate the possibilities of these strainers NOW!

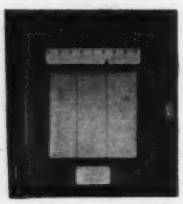
H. A. BRASSERT & COMPANY

60 East 42nd St., New York — First Nat'l Bank Bldg., Pittsburgh, Pa.

Repairing Worn Water Wheels

Worn water wheels can be repaired without removing them from the pit, and the wheels restored to their original efficiency. This has been done recently by engineers of the D. J. Murray Manufacturing Company, Wausau, Wis. Illustrated here are a section of water wheel after it was repaired in the pit, and the section removed from one of the blades showing the extent of erosion at the various points of the wheel. These badly eroded sections were cut away, right in the pit, and replaced with new pieces of stainless clad. Stainless steel band was applied to the inside of the casing at the points of erosion.

The water wheel illustrated generates 1800 KW, and is of cast iron, to which the stainless clad sections were applied. This method of repairing saves installation cost in or out of the pit, loss of time, and the cost of repairs is a fraction of the cost of a new wheel. The repaired wheel, it is said, will outlast a new wheel of conventional design, as the points of erosion are now protected by stainless steel.



2 pH RECORDS MADE SIMULTANEOUSLY

The Cambridge 2 point pH Recorder provides continuous, independent pH records on the same chart *from two separate sampling points.* Vapor-tight housing of glass electrodes in rugged, non-clog, flow-type chambers enable their installation wherever wanted. The Recorder may be located at considerable distance from sampling points.

Send us the details of your pH problems.

CAMBRIDGE INSTRUMENT CO., INC.,
3732 Grand Central Terminal, New York, N. Y.

CAMBRIDGE
THERMIONIC pH RECORDER

Talk Higher Newsprint Prices

MONTREAL, Que., November 24, 1941—According to the financial press here, there is an increasing agitation among newsprint producers for an upward revision in the price of newsprint to an extent at least that would give compensation for increased wage and other costs. As matters now stand consumers have been assured by the leading Canadian companies that the $50 price will continue until the end of the first quarter of 1942, and the discussion of the matter of price now seems aimed at arriving at some sort of understanding as to what will happen after that.

The effect of the new Canadian wage-price control regulations has complicated the outlook. To the extent that the regulations will tend to "freeze" or at least slow up advances in wage and other costs, the argument of newsprint producers for higher prices is weakened but on the other hand compulsory bonuses based on cost of living, will in effect increase wages. The regulations also may tend to keep at least domestic newsprint prices fixed. While Canadian newsprint consumption is relatively unimportant in comparison with U. S. purchases, the fact that prices are unchanged in Canada might make for difficulties in getting price increases on paper exported to the U. S., particularly if Washington takes action aimed to hold down prices of imported as well as domestic-produced goods.

Another consideration is the recent development of production of Nine Point paper—heavy type of newsprint for use by U. S. paper box manufacturers — Canadian newsprint machines which already has shot operations of several companies up close to capacity. A committee of newsprint producers is engaged in development of this new line of productive activity, and it appears likely that Nine Point paper production will increase. In the not distant future, prices in the spot market, for non-contract immediate delivery, may move up, and this would be likely to strengthen the case for upward revision in contract prices.

It has also been pointed out that a number of the larger companies are enjoying record activity and profits in non-newsprint lines, and one instance is quoted of a large company which, so far as earnings go, has become chiefly a kraft paper producer. Others have had surplus pulp for sale, or make board and special paper lines. It was, and still is, argued that the kraft and pulp business boom is likely to be temporary, and that it is important to cement the goodwill of publishers, as this may be important at such time as the war ends and Scandinavian pulp pours back into the U. S. market. Also, it is held, any appreciable advance in profits would have to be paid out in excess profits taxes.

The general summing up of the situation, as it appears at the moment, is that under the present organization set-up price increases are harder to arrange than price stability.

Paper Box Shipments Up

Shipments of folding paper boxes into the metropolitan New York area in October by members of the Folding Paper Box Manufacturers Association, Inc., were valued at $1,342,649, compared with shipments of $1,088,104 in September, and with shipments of $857,109 in October last year.

PERKINS HOLYOKE

TRADE MARK REG.

For the Paper Industry

Cotton Rolls
Cotton and Wool Rolls
Interleaved Rolls
Paper Rolls
Embossing Rolls
Chilled Iron Rolls
Granite Press Rolls
Glassine Supercalenders
Web Supercalenders
Friction Calenders

Sheet Calenders
Embossing Calenders
Plating Calenders
Laboratory Calenders
Burnishing Calenders
Ventilating Fans
Rag Cutters
Stock Cutters
Paper Dampeners
Tensile Testers

Mullen Testers

FIBERCELE

(the Ready-to-Use Tub Sizing)

OFFERS YOU

1. Simplicity of Preparation
(Needs only cooking to 190° at the desired Beaumé.)

2. Greater Uniformity of Viscosity
(Your production is always up to standard.)

3. Comparative Freedom from Foaming
(Ease of operation is assured.)

* * *

FIBERCELE imparts the sizing and strength characteristics required for top-quality papers, affording also unusual economies. We invite your inquiries.

NATIONAL STARCH PRODUCTS Inc.

820 GREENWICH ST., NEW YORK

Chicago — Philadelphia — Boston — San Francisco
and All Principal Cities

Paper Charities Big Success

The annual dinner of the Pulp and Paper Division of the New York and Brooklyn Federations of Jewish Charities, held Wednesday night, November 12, at the Hotel Biltmore, was one of the best attended and successful that the trade has sponsored. More than 150 men crowded the room to hear the addresses of Morris Gintzler, chairman of the division; Joseph Mazer, chairman of the dinner committee; and Monroe Goldwater, vice-chairman of the 1941 merged Federation appeal. Highlight of the dinner was the taking of pledges and donations, substantially increased over those of a year ago, for the 116 Federation hospitals and other welfare institutions serving Greater New York.

The keynote of the dinner was sounded by Mr. Gintzler, who after reviewing the history of the Pulp and Paper Division and some of its achievements on behalf of charitable causes, said: "The Federation job is a familiar one that we have worked at successfully for many years. In a time like this, it is good to find that many of our old values and traditions are still sound. The tradition of neighborliness, which we express through Federation, is certainly one of the most important of these."

Mr. Goldwater paid tribute to the Pulp and Paper Industry's years of effort on behalf of charitable causes, and mentioned of the social welfare achievements which the trade's generosity has made possible. Last year, he pointed out, the nine Federation hospitals provided more than 645,000 days of free care to the sick, without reference to race, creed or color—one-third of all free ward care given by all voluntary hospitals in Greater New York. The clinics and dispensaries, he said, provided well over 1,000,000 visits.

Co-chairman with Mr. Gintzler is Abraham Mazer. Isaac Gilman is honorary chairman. Honorary vice-chairmen are D. Samuel Gottesman and Henry Nias. Treasurer is Milton Collier.

The Executive Committee includes Charles Ballin, Philip S. Elkins, Max A. Finkel, Jacob P. Galewitz, Morris Gold, Nathan Heit, Morris Heller, Moe Israel, Irving A. Jaffe, Emanuel Katz, Morris Katz, Jacob Linetsky, William Mazer, Albert Newman, Fred E. Ruhling, Nathan Salwen, William M. Salzer, A. L. Scharf, Charles H. Schaffer, Max Schlanger, Bernard Sharp, Benjamin I. Sheldon, and Michael Sincoff.

Leaders of the various trade groups are: Vice-chairmen, Bag Manufacturers, Benjamin Mintz and William Salzman; vice-chairmen, Wrapping Paper Jobbers, Robert J. Rudnick, Jack Weill and George Stoll; vice-chairmen, Paper and Bag Jobbers, Hyman Schrier and Isaac Schrier; vice-chairmen, Cosmopolitan Twine and Paper Ass'n., Samuel J. Fishman, David Kasson and Meyer Schwartzapel.

Also vice-chairmen, Paper Box Division, Jacob S. Glekel and Jacob Sincoff; vice-chairman, Specialty Paper Division, A. R. Melker; vice-chairman, Board Division, Joseph H. Simon; vice-chairman, Twine Division. Charles G. Strisik; vice-chairmen, Metropolitan Paper Distributors Ass'n., Milton Posner, Louis Silfen and Arthur Stein; Tissue Paper Mills, Isidor Baum, Victor Cohen and Sam Wishnick.

Walsh-Healey Purchases

WASHINGTON, November 26, 1941—During the week ended November 8 the government purchased $1,940,777.46 worth of paper under the Walsh-Healey act, with the following orders;

$12,250 worth of paper fasteners for Treas. Proc. from Acco Products, Inc.; $21,500 worth of staples for Treas. Proc. from Boston Inc.; $11,000 worth of mimeo paper for GPO from Cauthorne Paper Company, Inc.; $10,470 worth of mimeo paper for GPO from Old Dominion Paper Company; $14,080 worth of bond paper for GPO from Resolute Paper Products Corporation; $16,560 worth of bond paper for GPO from R. P. Andrews Paper Company; $24,315.13 worth of writing paper for GPO from Paper Corporation of U.S.; $139,323.25 worth of duplicating machine supplies for War Air Corps from Ditto Inc.; $2,450 worth of paper clips for Treas. Proc. from Wm. C. Ballantyne; indefinite order, drinking cups for Treas. Proc. from Chas. G. Scott & Co. Inc.; $10,840 worth of bond paper for GPO from R. P. Andrews Paper Company; $23,000 worth of paper clips for Treas. Proc. from Sufrins Inc.; $13,440 worth of paper fasteners for Treas. Proc. from Chas. G. Stott & Co., Inc.; $10,540 worth of waste paper receptacles for Treas. Proc. from Natl. Vulcanized Fibre Co.; $29,880 worth of writing paper for GPO from Mudge Paper Company; $17,205 worth of mimeo paper for GPO from Old Dominion Paper Company; $11,583 worth of ledger paper for GPO from Whiting Paper Company; $430,051 worth of paper for GPO from Barton, Duer & Koch Paper Company; $64,115.25 worth of paper for GPO from Stanford Paper Company; $10,814.80 worth of index bristol for Panama Canal from Walker Goulard Plehn Company; $19,649.25 worth of memo pads for War QMC N.J. from Wansco Paper Prod. Company; $19,707.95 worth of book paper for GPO from Barton Duer & Koch Paper Company; $46,100 worth of toilet paper for Treas. Proc. from Gotham Tissue Corporation; $45,600 worth of paper towels for Treas. Proc. from West Disinfecting Company; $71,100 worth of paper towels for Treas. Proc. from West Disinfecting Company; $381,511.10 worth of paper for GPO from the Old Dominion Paper Company of Norfolk, Va.; $473,691.73 worth of paper for GPO from the Mudge Paper Company of Baltimore, Md.

A NEW
MEDIUM WEIGHT
Brandon
"Scapa-Hall"
Asbestos Felt
(The Number 54)

Woven on our new
English "Hindle" Looms

Special Features:

1 Medium weight—7 oz. sq. ft.
2 High percentage of asbestos
3 Part of back is asbestos
4 Oversize cotton warp for strength
5 Designed and engineered to give high porosity and absorbency
6 Widths 140" to 280"
7 Performance and economy guaranteed

Morey Paper Mill Supply Co.
309 SOUTH STREET, FITCHBURG, MASSACHUSETTS
(Sole Agents for BRANDON DRYER FELTS)

Dr. Flory to Address Chemists

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., November 24, 1941—Dr. Paul J. Flory of the Esso laboratories of the Standard Oil Development Company, will speak at the monthly meeting of the Northeast Wisconsin division of the American Chemical Society at Science hall of Lawrence College, Appleton, Wis., Tuesday evening, November 25. His subject will be "Chemical Reactivity and Constitution of High Polymers." His lecture will be concerned particularly with generalizations on the chemical properties of giant molecules and their composition.

SINCE 1828—FINER PAPER MILL MACHINES
PAPER MILL MACHINERY
Straight, Harper and Edwards Fourdriniers—For book, bond or fine tissues.
Cylinder and Wet Machines. Jordans — Pumps — Calenders "Rainstorm Shower Pipes".
Below: THREE PLUNGER STUFF PUMP
For the Finishing Room
UNDERCUT TRIMMER
Electric Eye Web Edge Control — Slitters — Reels — Rotary Cutters.
Above: Rotary SPOT CUTTER
FOR BAG PLANTS
Flat, square and satchell bottom bag machines—single and multiwall pasted valve bag machines — tuber and bottomer type bag conveyors.
Below: HEAVY DUTY MULTIWALL TUBER WITH COMPLETE AUTO COMPENSATOR FOR PREPRINTED ROLLS.
1828
The SMITH & WINCHESTER Manufacturing Company
SOUTH WINDHAM CONNECTICUT
6

Crepe Paper Men File Answer

WASHINGTON, D. C., November 26, 1941—Eight manufacturers of crepe paper and an unincorporated trade association whose membership is composed of six of the respondent corporations have filed answers to a complaint issued by the Federal Trade Commission which charged them with entering into a conspiracy and combination to hinder and prevent price competition in the sale of crepe paper.

A joint answer was filed by National Crepe Paper Association of America and George J. Lincoln, Jr., its secretary and manager, Philadelphia; American Tissue Mills, Holyoke, Mass.; Charles T. Bainbridge's Sons, Brooklyn; The Papyrus Company, Kenilworth, N. J.; C. A. Reed Company, Williamsport, Pa.; and The Tuttle Press Company, Appleton, Wis.

A general denial of all the allegations of the complaint is made in the answer, including charges that the respondents fixed and maintained uniform delivered prices; established and maintained, pursuant to a conspiracy or understanding, geographical zones of identical delivered prices, zone boundaries, and price differentials between the zones; that the respondents abitrarily computed or averaged delivery costs and freight allowances within each delivered price zone, or that any such computation or averaging has been done to prevent differences in delivery costs from the various plants of the respondent manufacturers to their customers; and that the respondent manufacturers agreed to file with the respondent Association their price lists of delivered prices for crepe paper or that they agreed that they would not change or deviate from any filed prices until new and different prices were filed by them.

The answer further denies that the respondents agreed to file with the respondent Association invoices and other private price information, agreed with the respondent Association to, or that the Association did, disseminate such price information to all the respondent manufacturers, or that they have fixed and maintained uniform discount and other terms and conditions for the sale of crepe paper.

The answer further denies allegations of the complaint that the respondents adopted and maintained standard uniform colors, sizes and ratios in order to facilitate and maintain identity of prices, or that they have used any other means or methods designed to suppress and prevent price competition or to accomplish uniformity of delivered price in the sale of crepe paper.

Individual answers of the Dennison Manufacturing Co., Framingham, Mass., the Fort Howard Paper Company, Green Bay, Wis. and The Reyburn Manufacturing Co., Philadelphia, also make general denials of all allegations of the complaint of entering into any agreement or conspiracy for the purpose of restraining or restricting competition in their products. The answers further deny that the respondent Association of George J. Lincoln, Jr., had, on behalf of the two respondents, participated in any of the illegal activities alleged in the complaint.

Training Classes

Special Employee Training Classes are now in operation at the plant of the Powell River Company at Powell River, B. C. Several months ago, the management of the Powell River Company drew up a plan to provide employees with special trade training. This plan is not to be confused with the regular apprenticeship training, which has been in force for the past eight years.

The objectives of the present plan which went into active operation early in September were two-fold. First, there was the idea of having as large as possible a reserve of trained or partially trained men for machine ship work—men for the drill presses, the lathe, the shapers and the many and varied machines that are part of every well-equipped pulp and paper plant. The purpose was not necessarily to turn out finished machinists—but to have a corps of partially trained men ready to step into the shops as vacancies occurred or new jobs were created.

The second objective links up directly with Canada's war effort. The trainees are being prepared for possible war work, which will likely materialize as we approach all-out production. There are various types of repetition war work which may be done by partially trained men familiar with one machine. Powell River's machine shop operates only one shift for mill operations. When the call comes, extra shifts will be arranged for the spare hours available—and this corps of men will be ready and trained to carry on immediately.

The classes are very popular. When the first notice was printed about eighty employees applied for permission to enrol. Now every evening, six days a week, earnest groups of students are busy from 6 to 9 o'clock learning the mysteries of machine shop practice.

The whole plan comes under the jurisdiction of Acting Mechanical Superintendent Ross Black, who takes a keen personal interest in the work. Class instructor is Mr. Herbert White of the mechanical staff, who combines this work with his regular duties as machinist on evening duty.

There is no cost to the employee for the training. All expenses are borne by the firm.

THE DIVINING ROD

The Divining Rod is still used by the old fellow above, to find water.

A papermaker's felt, on the contrary, is used for getting rid of water, swiftly and uniformly across a web of paper.

Draper Felts **are scientifically designed to do this very thing — but they must be designed with respect to your special needs.**

A Draper Representative **will cooperate in solving any of your felt problems.**

Draper Felts Favor Efficiency

DRAPER BROTHERS COMPANY

Woolen Manufacturers Since 1856 CANTON, MASS.

OUR REPRESENTATIVES *to serve you*

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C. K. BEECHER, Delaware, Ohio
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O. J. LELOFF, Vancouver, Wash.
RALPH E. BRIGGS, Canton, Mass.

PAPER
TRADE JOURNAL
This Reg. U. S. Pat. Off.
Henry J. Berger
EDITOR

Vol. 113 November 27, 1941 No. 22

PRICE CONTROL

Price control has been advocated as a definite and effective curb to inflation. If severe inflation is to be properly controlled and checked in its early period, some economists insist that the first step should control prices. Another view is that by establishing maximum prices on the most important or key commodities, a similar objective will be achieved.

When taking office as Federal Price Administrator, Leon Henderson, declared that "No amount of penalties will substitute for additional supplies. If we go to the place where reliance is on sanctions and legal punishment we will have reached, in my opinion, the top of our productive effort. If forceful action is needed, it will be a far cry from enlarging the jails . . . but will result in lots of thought and investigation of what's back of it." Commenting on the labor unions whose demands might contribute to increased prices of important commodities, Mr. Henderson said: "We will watch wages as a prime cost factor. If unwarranted wage rises are in prospect, we will have a decided interest in them."

Price control legislation has taken form rather slowly. The new pending measure is less thorough than many advocates of blanket price control believe is essential. The plan proposed by Bernard M. Baruch is similar to that adopted by Canada, which provides control over all prices and wages. On the advice of President Roosevelt and Administrator Henderson, wages and public utility rates were excluded. It was declared by the President, Secretary Morgenthau and Mr. Henderson, that wages are not a commodity and should not be included in a price-control bill. As a result, the measure of the pending price control bill as formulated by members of the House Banking and Currency Committee has been called a price-restraining plan, and not a definite check on rising prices as provided by the Baruch, or Canadian plans.

Among the important restrictions written into the bill are certain provisions giving the Administrator no authority to fix maximum prices on materials processed from agricultural products. The farm bloc in the Committee added further limitations that no price ceiling can be fixed that will influence lower farm prices prevailing on October 1, or below the average between July 1, 1919 and June 30, 1929. The result is that the minimum price ceilings for 16 out of 27 major farm products has been raised above 110 of parity. As parity is computed to include the cost of all products the farmer must buy, parity rises steadily with the prices of all products the farmer must purchase; the increase in the last year being 8%.

Another important restriction was the elimination for enforcement of price-control orders by the deletion of licensing provision, thus retaining only the alternative plan of enforcement through fines and imprisonment. The licensing plan would require a license to operate a business, and the license would be subject to cancellation for price violation. It is believed that this plan would make it practicable to enforce price controls in fields affecting a large number of dealers, thus providing a check to the undue rise in retail prices. In its present form the price-control bill would exclude wages. It would set a ceiling price of $1.34 per bushel on wheat, compared with the October 15 price of .91; $1.46 per bushel on apples, against .87, and fix the lowest ceiling price at .41½ cents for one dozen of eggs, which were selling at .32 cents last month in the wholesale markets. Price ceiling would be most largely applied in industries, with minimum price fixing for retailers and no rent control is provided for.

As the House has full freedom to express its views and make its own legislation, it is possible that the Gore bill may be substituted for the measure just discussed. This plan embodies most of the recommendations of Bernard M. Baruch, price administrator during the World War. In appearing before the Rules Committee on November 21, Mr. Baruch submitted his recommendations, in part as follows: "(1) That the Congress give immediate consideration to a price-control bill. (2) That such consideration be based upon as wide a front as possible, which means the development of control that shall guarantee a sufficiency, at minimum prices, of the three necessities of life—shelter, food and clothing. (3) That in setting up price limits, there must be controls established on rents, on agricultural schedules and on wages—on everything. (4) That all segments of society must be treated equally and profiteering eliminated. We must really take the profits out of war as we have promised to do for so long . . . (5) That control of prices must march along with a sound taxation program, profit and money control, increase of production of raw materials and goods, substitution, standardization and simplification, conversion of facilities, subcontracting to use small as well as big establishments."

In reference to wages, Mr. Baruch said that he was opposed to an inflationary wage scale and did not advocate freezing existing wage schedules. Adjustments would be made, he said, of his plan whenever necessity exists. The rates would be susceptible to

increases and perhaps decreases, upon the establishment of changes in the worker's income and his expenses.

As a result of a referendum vote among its member organizations, the Chamber of Commerce of the United States comments on the method of administrating a price-control law, in part as follows: "The administration of the act is now placed in an administrator, to be appointed by the President and confirmed by the Senate, with the administrator having all powers. The Chamber supports this method but it advocates a board of five members. The administrator would consult with representative industry committees but he himself would appoint them. The Chamber advocates clear provision for selection by the industries themselves."

To Install Pyrites Furnace

[FROM OUR REGULAR CORRESPONDENT]

Washington, D. C., November 26, 1941 — The second of Canada's commercial pyrite furnaces for that country's pulp and paper industry is about to be installed, according to a trade report received here recently.

Announcement was made by a large Quebec manufacturer of pulp, newsprint, and specialty papers that the acid plant heretofore using imported sulphur will be replaced by one in which Canadian pyrites will be burned to obtain sulphur dioxide gas. A primary factor in the decision to make this change it was stated, was that the older plant required substantial changes and replacements.

Two sources in Canada offer concentrated pyrite, both located in Quebec province; one of these properties was developed primarily as a source of iron pyrite, and the second is a large copper-gold property, with pyrite as a by-product in the ores.

The possibility of using pyrite as a substitute for sulphur hitherto imported in large quantity from Texas, has been actively studied for more than ten years, it was said, and an experimental furnace was installed in Quebec province back in 1930. Furnaces initially developed were not entirely successful, but several years ago a paper company installed an improved type and now a considerable part of that company's sulphur requirements is met by pyrites from this furnace.

Total sulphur imports for use by the Canadian pulp and paper industry and others amounted to 152,216 tons, valued at $2,453,836 in 1939, of which the paper and pulp industry consumed 126,818 tons.

Ohio Waste Paper in New Building

COLUMBUS, Ohio, November 10, 1941—Operations of the Ohio Waste Paper Company have been transferred to a modern, fireproof warehouse at 95 N. Glenwood avenue, according to J. A. Barnett, president of the firm.

The concern was formerly located at 683 Wager street and in its new location will have greatly expanded facilities for carrying on its present business.

Mr. Barnett also announced association with the company of his son, Murry Barnett.

Production Ratio Report*

(Production as per cent of six-day capacity)

COMPARATIVE WEEKLY SUMMARIES

Current Weeks, 1941		Corresponding Weeks, 1940	
October 11	102.1	October 12	86.2
October 18	104.9	October 19	84.3
October 25	107.5	October 26	85.9
November 1	109.7	November 2	85.6
November 8	104.0	November 9	85.6
November 15...(Prelim.)	*106.5*	November 16	84.7

COMPARATIVE MONTHLY SUMMARIES

Year	Jan.	Feb.	Mar.	Apr.	May	June	July
1940	89.1	84.7	82.3	84.3	90.0	92.1	85.3
1941	85.6	89.7	92.2	96.4	98.9	99.5	94.8

Year	Aug.	Sept.	Oct.	Nov.	Dec.	Year Avg.
1940	85.1	81.5	85.5	84.9	80.9	85.6
1941	101.8	99.6	*105.4*	...	...	...

COMPARATIVE YEARLY SUMMARIES

	1935	1936	1937	1938	1939	1940	1941
Year to Date.	69.6	79.7	83.2	71.3	82.3	86.1	*96.7*
Year Average..	69.9	80.4	79.8	71.5	83.4	85.6	...

* Based on tonnage reported to American Paper and Pulp Association. Does not include mills reporting to National Paperboard Association, except in isolated cases where both paper and paperboard are produced and separate tonnage figures are not readily available. Does not include mills producing newsprint exclusively.

PAPERBOARD OPERATING RATIOS †

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year Avg.
1936	62	67	67	70	69	70	69	75	78	82	80	74	72
1937	80	86	86	88	85	77	66	74	69	65	55	45	73
1938	54	60	61	57	58	56	57	66	66	70	65	59	61
1939	60	67	71	69	64	67	63	72	74	84	81	71	70
1940	71	70	69	70	76	79	72	74	72	79	77	71	73
1941	75	81	82	83	84	88	86	94	94	99	..	..	..

Week ending Oct. 11, 1941— 99
Week ending Oct. 18, 1941— 98
Week ending Oct. 25, 1941—100
Week ending Nov. 1, 1941—99
Week ending Nov. 8, 1941—97
Week ending Nov. 15, 1941—99

† Per cents of operation based on "Inch-Hours" reported to the National Paperboard Assn.

Urges Speed in Forest Program

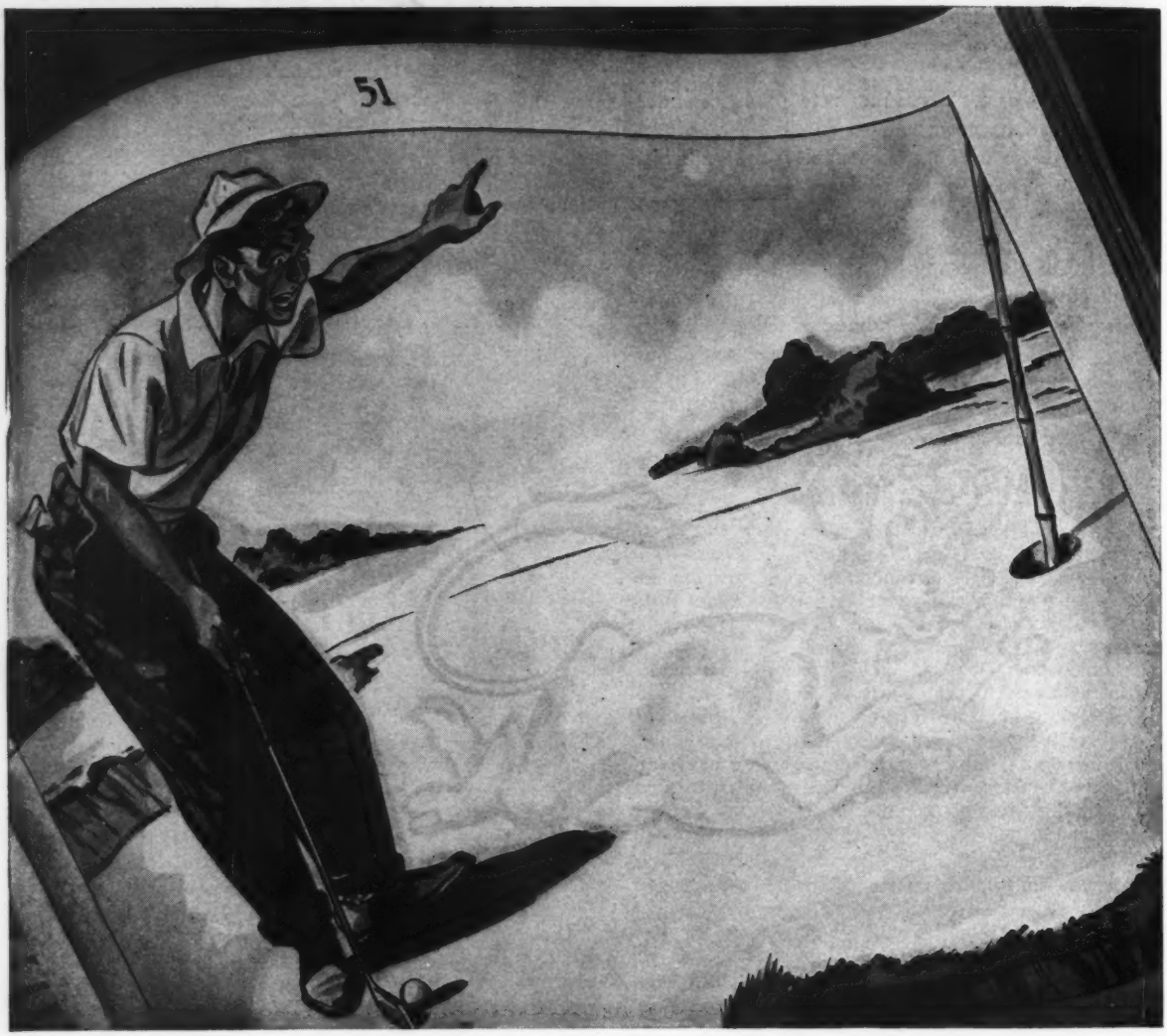
APPLETON, Wis., November 24, 1941—Speeding up of the forestry program is necessary to keep pace with the timber demands, Jay Price of Milwaukee, Wis., regional director of the United States Forestry Service, declared in an address at the state convention of the Izaak Walton League at Appleton, Wis., Saturday, November 15. It takes a generation to produce a crop of pulp wood, he said. "We are not going fast enough in conservation. We need to speed up our efforts to a greater pace."

In Wisconsin today, Mr. Price said, one out of twelve acres has merchantable timber on it. Five out of twelve acres "aren't doing much," and the remaining six out of twelve "have a pretty good crop of young trees."

America is doing a better job with old forests, the speaker pointed out. Selective logging is eliminating waste and assuring development of future timber. Besides, the study of wood utilization is important in the conservation field, pointing to the accomplishments in particular of the United States Forest Products Laboratory at Madison, Wis.

Conservation as it applies to America's forests probably will resolve itself into a program combining three developments, the purchase and management of timber land by state or federal governments, education of the public and the timber owners, and legal requirements on "how forest land should be handled," Mr. Price maintained. Europe ultimately will have to import wood products, he added, and the United States and Canada will be the leading exporters.

Despite the growing demand for timber because of the defense program, the speaker concluded, there is no need "to use up the forests.



"What a stymie!"

...MOOED THE COW ON PAGE 52 TO THE MAN ON PAGE 51

"You heard me!" shouted the golfer. "Beat it. Vamoose!"

"Oh, but I'm so comfy," sighed the cow. "These lazy spring days. Ho-hum . . ."

"What you need are some Krebs pigments!"

"Pigments? A new cure for spring fever?"

"No!" roared the golfer. "A cure for a *show-through* like you. Krebs pigments take *show-through* out of the thinnest paper."

"Is that so?" yawned the cow. "Tell me more!"

"It's the truth. Krebs make paper white as your milk.'

"Huh! Stop getting personal."

" 'Bout time I did," said the golfer. "Besides, Krebs pigments make printing stand out sharp and clear, too."

"That so? Most interesting, most interesting . . ."

"Darn right! And those Krebs experts can solve . . ."

"Anything? Good. Let 'em go to work on that wicked slice of yours."

"Not *golf* experts . . . they're *pigment* experts. Krebs technical men can solve the toughest pigment problems."

"You don't say. And now I suppose the big smart man is going to report me to the Grounds Rules Committee?"

"No!" roared the golfer. "I'm going to write Krebs direct myself *today*."

KREBS PIGMENT & COLOR CORP.

1007 Orange Street...Wilmington, Delaware

Section of the
Technical Association of the Pulp and Paper Industry

Edited by Ronald G. Macdonald, Secretary

A Multipurpose Photoelectric Reflectometer

By Richard S. Hunter[1]

Abstract

The multipurpose reflectometer was developed primarily to measure apparent reflectance, specular gloss, and trichromatic coefficients. These measurements are useful in the ceramic, paint, textile, paper, and chemical industries to indicate lightness, gloss, and color of finished articles. Of particular interest to the pulp and paper industry is the use of the device to measure apparent reflectivity for blue light, otherwise known as "brightness." In the reflectometer, two light beams from a single source are directed along separate paths to two barrier-layer photocells. The reflectometer employs a substitution null method and requires a galvanometer to indicate equality of the currents generated by the two photocells. For each sample tested, there is a photometric adjustment to restore equality of the currents. The amounts of photometric adjustment are measured on the direct-reading scales, one of which is used for apparent reflectance and the other for specular gloss. Because of its high precision, the instrument is well suited for measuring small differences in apparent reflectance, gloss, or color of nearly identical samples. However, for greatest accuracy, it is necessary to correct the scale readings by calibration.

The following description has been condensed from the full length paper appearing under the same title in the November, 1940 issues *(11)* of the *Journal of Research of the National Bureau of Standards* and the *Journal of the Optical Society of America.* It is thought that a number of paper technologists who do not ordinarily see the two journals in which the paper originally appeared may be interested in this instrument and its uses. The measurement which is popularly termed "brightness," but is properly designated 45 deg., 0 deg. apparent reflectivity to blue light, is of particular interest at the present time because of the voluntary reduction of the amount of chlorine used for bleaching pulp. This reduction for the cause of defense is being worked out with the help of "brightness" measurements. The present paper gives an example showing "brightness" measurements made with the multipurpose reflectometer.

I. The Instrument

The multipurpose photoelectric reflectometer is the result of an attempt to combine in one instrument means for measuring (1) 45 deg., 0 deg. luminous apparent reflectance relative to a standard, (2) 45 deg., 0 deg. apparent reflectance relative to a standard through filters for either tristimulus colorimetry or abridged spectrophotometry, (3) four of the six listed types of gloss *(9)*, and (4) the transmission of clear liquids and optical filters having plane parallel faces.

In Fig. 1 is a diagram of the multipurpose reflectometer with a partial elevation through *C-C* to show the path of the gloss beam[2] to and from the gloss surface. The lines indicating both the centers and the edges of the light paths from the source to the respective photocells are heavy. The positions of all elements necessary for the operation of the instrument are shown. The elevated part of the gloss beam between the mirrors, *A* and *B*, is omitted in the plan but is shown in the partial elevation.

The instrument is designed to operate according to a null method. Light from the single source is di-

[1] National Bureau of Standards, Washington, D. C.

[2] "Gloss beam" is used hereinafter to designate the pencil of light which is separated from the entrant beam by the small aluminum mirror, *A*, and which ultimately reaches the stationary photocell. "Gloss photocell" is used to designate this photocell and "gloss surface" to designate the surface, in position to receive the beam at 45° and reflect it at —45° along the path toward the gloss photocell.

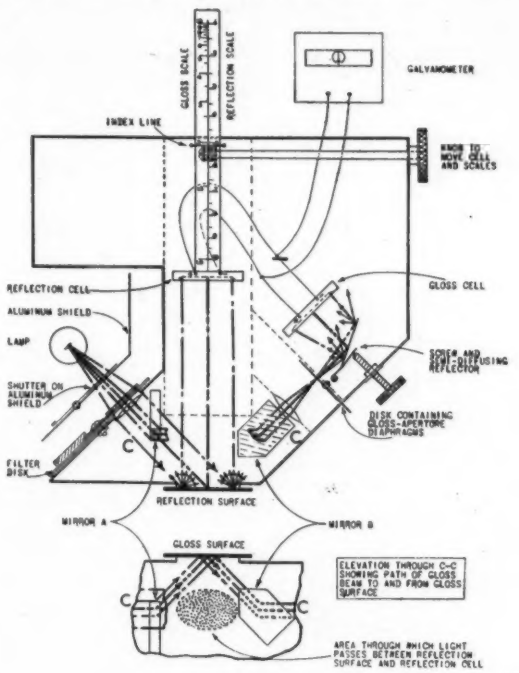


FIG. 1
Diagram of multipurpose reflectometer.

vided into two beams, each of which ultimately reaches a barrier-layer photocell. The two cells are connected, with polarities opposing, to the terminals of the galvanometer, giving the current-balancing circuit described above. The paths followed by the two beams are purposely geometrically different so that different operations may be performed with them. Light diverges from the filament of the projection lamp and passes through a round window in the aluminum insulating shield. Beyond this shield, the beam may pass through one of several spectrally selective filters on a disk and reach the collimating lens mounted in the wall of the instrument housing. The approximately parallel beam leaving this lens then proceeds, in large part, to the vertically placed reflection surface[3] on which it is incident at 45 deg. The reflection photocell to which the scales are attached, "views" the reflection surface from a variable distance.

The plane mirror, *A*, intercepts a small part of the cylindrical beam and reflects it upward to incidence at 45 deg. on the horizontally placed gloss surfaces. The light reflected by this surface at an angle of mirror reflection,—45 deg., strikes mirror *B*, which is in the same plane as mirror *A*. The center of this gloss beam is thereby returned to the horizontal plane and passes through a lens and "gloss aperture," where an image of the source is formed. Behind this aperture is the semidiffusing reflector, adjustable in its angular position to control the fraction of light directed from it to the gloss cell. Several different apertures in a disk may be interchanged to vary the spread *(13)* of the light in the gloss beam passed toward the gloss cell for measurement.

Two scales are ruled on the arm attached to the movable reflection cell, one for reflection, the other for gloss. Stray light which might register on the photocells is reduced to a minimum by painting interior surfaces of the instrument a dull black, by mounting the movable reflection cell in a tunnel, and by dividing the instrument interior into compartments separated by the sheet-metal partitions indicated by light dotted lines in Fig. 1.

Because test samples may be introduced in either the gloss or the reflection beams and because the gloss beam may be extended above the instrument into attachments for performing additional operations, the multipurpose reflectometer will measure a number of different quantities. For every operation except that of measuring contrast gloss, one beam is made the comparison beam, the other the test beam. Whenever $A_{45}°, {}_{0}°$ is measured, the comparison surface, which must be permanent in its specular reflection, is placed in the gloss position. Conversely, a surface for which the value of $A_{45}°, {}_{0}°$ is stable is inserted in the reflection position whenever the gloss beam is used for the specimens to be tested. The comparison specimen, whether it is a mirror or a dark-gray porcelain-enameled plaque, need not be calibrated. The calibrated standard is always one which may be inserted in the instrument in the same position in which the samples are thereafter exposed for measurement, as is customary in all substitution methods.

Three multipurpose reflectometers are in use at the National Bureau of Standards. In these instruments the reflectometer shell and interior partitions are of sheet metal, mainly 20-gage galvanized iron painted inside with matte black and outside with black-crystal finish. The reflectometer body is 40 cm. wide and 16 cm. high. The relative sizes of the compartments and elements within the instrument are indicated in Fig. 1.

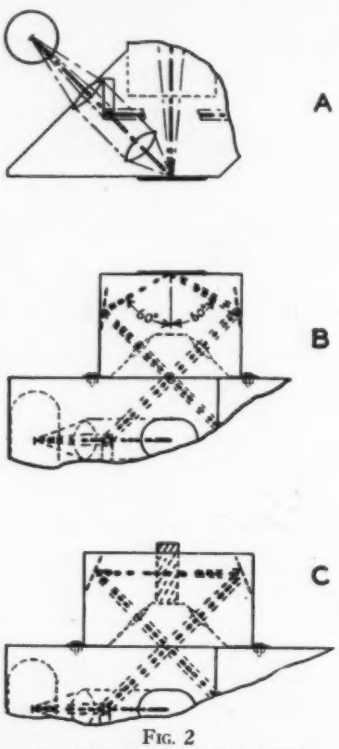


FIG. 2

Three reflectometer attachments for special functions. *A*, For approximate values of $A_{45°,0°}$ of nonflat surfaces and surfaces of small area; *B*, for 60°,—60° specular gloss; *C*, for transmission.

II. Attachments for Special Operations

The first of the several attachments built to adapt the instrument to special problems is a stand (not illustrated) to lift the reflectometer about 8 inches above the table top and mount it in a vertical instead of a horizontal position so that dry powders or opaque liquids in open pans may be introduced for 45 deg., O deg. measurements. When the reflectometer is used in this position, the lamp mounting must be turned, because projection lamps must always be operated with base down.

Figure 2 *(A)* a device which is used with nonflat surfaces or with surfaces too small in area to fill the full reflection opening. The device consists of a simple lens (20 dipoters, 42 mm diam) which converges the incident beam to three-eighths inch in diameter at the plane of the reflection surface. During the use of this attachment, a major portion of the incident beam departs significantly from 45 deg. incidence. Since, moreover, nonflat surfaces and surfaces too small to measure in the usual manner are difficult to position accurately for measurement, the apparent reflectances obtained with their attachment are not as accurate as those obtained in the usual manner.

To measure specular gloss at angles other than 45 deg., attachments of the type shown in Fig 2 *(B)* are mounted on top of the reflectometer and test specimens are placed upon them. By changing the di-

[3] Surfaces inserted in this position may be measured for $A_{45°,0°}$. This position of the test sample is hereinafter termed the "reflection position" to differentiate it from the position in which samples are placed for gloss measurement. The beam is termed the "reflection beam," and the viewing photocell is termed the "reflection photocell."

mensions and the angles of the two mirrors, the type of device may be designed for specular-gloss measurements at any angle desired. Measurements at both 60 deg., Fig. 2 *(B)*, and at 75 deg., Fig 4, have been made with the multipurpose reflectometer. Used with the small gloss aperture, the 60 deg. attachment has been found to give gloss values of painted surfaces in fairly good accord with those derived according to the ASTM Tentative Method of Test for Specular Gloss of Paint Finishes *(1)*. Samples of paper are frequently rated for glossiness on the basis of shiny appearance at near-grazing angles of view. Values of specular gloss measured at 75 deg. from normal have been found to correlate well with these grazing-angle ratings of paper glossiness.

For transmission, Fig. 2 *(C)*, the gloss beam is directed horizontally through the top of the same type of device. Clear liquids in glass cells and clear solids with polished parallel faces are then inserted for measurement.

III. The Scales

With the multipurpose reflectometer every setting on an unknown sample is made by moving the reflection cell to a position at which the current it generates balances that generated by the gloss cell. The scales of the instrument are attached to the reflection cell and pass under a ruled index line in the manner indicated in Fig. 1. Roughly, the gloss-scale settings vary inversely as the square of the distance between the reflection surface and the reflection cell, and the reflection-scale readings vary directly as the square of this distance.

For the first multipurpose reflectometer, direct-reading scales were prepared using as guides instrument settings on a series of porcelain-enamel plaques of known luminous apparent reflectances. For subsequent reflectometers, printed duplicates of the scales drawn for the first instrument have been used. Although these later instruments have not duplicated the first device in every detail, it has nevertheless proved practical to use the printed duplicate scales and then prepare for each instrument the separate scale-correction curves. The scale errors which must be corrected are, for many conditions, not large. The paragraphs following describe the preparation of the first scales.

A centimeter scale was mounted on the scale arm of the first multipurpose reflectometer in such a position that it indicated the distance from the reflection surface to the reflection-cell face. Null settings were then made on each of the porcelain-enamel plaques of a previously measured white to medium-gray series, and the values of $A_{45°,0°}$ of these plaques were plotted against the distances, giving the dots in Fig. 3.

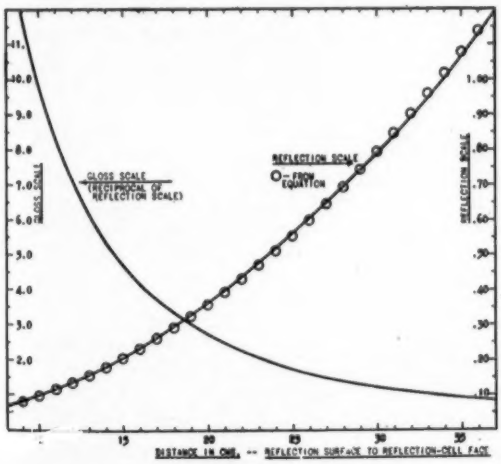


FIG. 3

Small-scale copy of the reflection- and gloss-scale calibration curves of one multipurpose reflectometer. The circles are relative values of F_1/F_2 calculated from Walsh's equation with $r = 2.5$ cm.

The circles in this figure were obtained from a photometric equation which nearly fits the experimentally determined scale. The fraction of the total flux from one circular disk radiating according to Lambert's law which reaches a second disk of equal radius, both disks being perpendicular to the line joining their centers, is, according to Walsh *(24)*,

$$\frac{F_2}{F_1} = \frac{1}{2r^2}\left[2r^2 + d^2 - d\sqrt{4r^2 + d^2}\right],$$

where r is the radius of the disks, d their distance apart, F_1 the flux radiating from the face of the first disk and F_2 the flux incident upon the second disk. For an instrument fulfilling the ideal conditions, this equation would serve for spacing the rulings on the scales;[4] in the present case it proved valuable as a check against the experimental calibration. Setting r=2.5 cm, a series of values of F_2/F_1 were computed relative to that at 33.8 cm (the distance corresponding to a scale setting of 1.0). The reciprocals of these numbers were plotted in Fig. 3 as a function of d. The reflection-scale curve was then drawn through the experimentally determined dots, using the circles to guide in locating the interpolated and extrapolated parts of the curve.

The curve for gloss, also plotted in Fig. 3, is the locus of points whose ordinates are reciprocal to the corresponding ordinates of the reflection-scale curve. In measuring gloss, it will be remembered, test sample and comparison surface positions are reversed, hence the inverse relation of the gloss scale and the reflection scale.

The direct-reading scales were ruled from a carefully prepared enlargement of Fig. 3. The reflection scale extends from 0.10 to 1.00 and is convenient because of the fairly uniform, open spacing of the scale intervals, evidenced in Fig. 3 by the lack of a marked change of slope of the corresponding curve. The gloss scale extends from 1.00 to 10.0, but the scale intervals are not so uniformly spaced;[5] in fact, the close spacing between 5.0 and 10.0 makes it often advisable to use a scale setting between 4.0 and 6.0, instead of 10.0, as the 100% setting for transmission measurements. From the carefully ruled pair of direct-reading scales, a zinc etching properly reduced in size was made, and from this etching the scales used in the instruments have been printed.

IV. Eliminating or Minimizing Orders

Eighteen potential errors in multipurpose reflectometer measurements are listed in Table I, together with the evidence by which the presence of each is

[4] Failure of this function to apply to the actual instrument arises, in major part, from the presence of stray light, which it is impossible to eliminate entirely, and, to a lesser degree, from the fact that the reflection surface and, in some cases, the reflection photocell are not circular. This failure of the scale to fit Walsh's function is noted in the study of a multipurpose reflectometer by the Institute of Paper Chemistry *(16)*. They mistakenly assumed in their study that it was intended to have the reflectometer scale fit such a photometric relationship. Actually, in using Walsh's equation, it was intended only to verify in an approximate manner the experimental calibration for interpolation purposes.

[5] It will be found that—$\log_{10}T$, into which transmission (T) is frequently transformed, is more nearly a linear function of scale distance than is T.

detected and the procedure employed to minimize or eliminate each. The 18 are divided into a group of 12, identified by inconstant operation of an instrument, and a group of 6, the presence of which can only be established by the failure of one instrument to check results from another.

V. Applications of the Instrument

The multipurpose reflectometer has high precision and will identify small differences in apparent reflectance, color, gloss, and other properties; but it furnishes only relative, not absolute values. The solution of many problems met in practice requires, however, that the samples of a group merely be exposed for readings from the instrument and then be arranged in order according to the property in question. When this is the case and the samples of a group are similar, the last six sources of error which are so difficult to eliminate may often be ignored. Calibrated standards are not needed. A great saving of labor, in comparison with the amount required for accurate work, is therefore possible.

For quantitative results, a working standard representing the property being measured must be available. This standard should have an assigned value near those of the samples being measured. A substitution method, in which the samples are substituted for, rather than compared with, the standard, is employed. Of the two light paths the one not used for the samples being tested becomes the comparison beam; in it a single uncalibrated specimen is used.

The standard employed for an operation with the multipurpose reflectometer is seldom the primary standard of the property measured, but instead is usually a secondary or working standard which has been carefully calibrated in terms of the proper primary standard. In order to make the variety of measurements possible with the multipurpose device and to have available for any group of samples a standard of similar specifications, a large variety of working standards is needed. In the following description of the operations of the instrument, both the primary standard for each operation and the types of secondary standards most frequently employed are

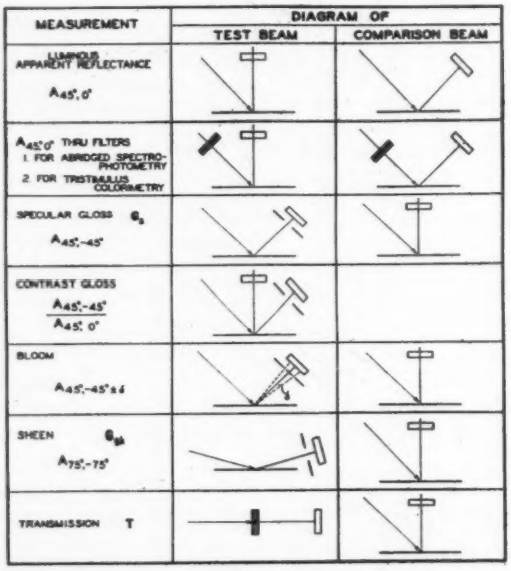


FIG. 4

Different operations of the multipurpose reflectometer showing functions of both the test and comparison specimens for each operation. (The green filter, required with the GE cell for all measurements according to the luminosity function, is not shown.)

TABLE I.—ERRORS IN MULTIPURPOSE REFLECTOMETER MEASUREMENTS, THEIR CAUSES AND CONTROL

Evidence of presence of error	Cause of error	To minimize or eliminate the error
A. ERRORS EVIDENCED BY INCONSTANT OPERATION OF SINGLE INSTRUMENT		
From Characteristics of the Photocells		
1. Change of settings with temperature of instrument.	Change of photocell current with temperature.	Allow instrument to warm up to equilibrium and check with standard frequently to detect drift.
2. Galvanometer drift after opening shutter.	Change, with time, of current from one photocell relative to that from the other (fatigue).	Use photocells paired for equal rate of drift and thus eliminate residual drift.
3. Galvanometer response to change of line voltage.	Change with source intensity of current from one photocell relative to that from the other.	Use photocells paired for like changes of current with identical changes of illumination.
4. Persistent failure of instrument to reproduce readings made shortly before; galvanometer drift.	Failure of contacts within photocells.	Renew electrical contacts within cells, or replace cells.
From Design of the Instrument		
5. Galvanometer response to movement of a light past cracks and openings in the instrument.	Light leakage	Make housing light tight, or use instrument in a darkened room.
6. Galvanometer response to pressure on, or movement of, instrument during a setting.	Lack of structural rigidity	Build instrument rigidly; handle carefully during use.
7. Erratic operation.	Dirt on optical parts.	Clean parts affected.
From Characteristics of the Sample		
8. Galvanometer response to change of line voltage only when instrument beams have markedly different spectral composition.	Marked spectral difference of samples in two beams.	Operate source at constant voltage when beams have markedly different spectral composition.
9. Change of instrument reading with change of area of surface exposed.	Nonuniformity of surface of the sample in the quality being measured.	Designate area of surface measured.
10. Change of instrument reading with wobble of surface over opening.	Nonflatness of surface of sample....	Flatten surface or designate exact position during measurement.
11. Change of instrument reading with rotation of sample surface.	Variation of apparent reflectance of surface with rotation in its own plane.	Make and average four readings of sample rotating it 90° between each pair of readings.
12. Change of reading with exposure of sample to light, time, humidity, or other treatment.	Impermanence of characteristics of sample.	Treat sample so affected with care and give history prior to measurement.
B. ERRORS IDENTIFIED BY USE OF SEPARATE INSTRUMENTS		
13. Failure of reflectometer to check accurate results from separate instruments.	Inaccurate scales....	Prepare and use scale-correction curves.
14. Do	Inaccurate calibration or change of standard.	Remeasure standard.
15. Failure of reflectometer to check accurate results from separate instruments (frequently appears when results are compared with those from instrument of different type).	Inexact duplication of specified directional conditions of measurement.	Examine angular conditions of measurement of both instruments involved. (Do not expect accurate duplication of results if there are differences.)
16. Failure of reflectometer to check accurate results from separate instruments. (Penetration of light is often visible at edges of sample.)	Loss of light by lateral passage after penetration into translucent sample.	Measure on instrument having negligible penetration loss.
17. Failure of reflectometer to check accurate results from separate instruments.	Failure of spectral response of source-filter-photocell combinations to duplicate those required.	Use standards spectrally similar to samples measured.
18. Do	Fluorescence of samples	Samples must be measured on instrument not subject to fluorescence error.

mentioned. These standards are noted in Table II.

Plaques for secondary standards are, of course, chosen from stable materials. Ceramic materials, because of their relative permanence, are widely used as working standards for apparent reflectance, gloss, and trichromatic, coefficients. In certain cases, surfaces of lacquer, paint, plastic, paper, or dry powder are also satisfactory as standards; but specimens of any of these latter materials must be checked for permanence before use as standards. Moreover, since several porcelain enamels and ceramic tiles have been found to change color significantly with time, exposure to light, contact with water, or with other treatment, it may be said that each ceramic as well as nonceramic material must be suspected of uncertain permanence until it has proved to be otherwise. However, most porcelain-enamel plaques, blocks of opaque glass, and vitreous tiles used as standards have proved to be stable.

Considering abridged spectrophotometry and tristimulus colorimetry in seperate categories, eight different measuring operations can be performed on the multipurpose reflectometer. These are shown in Fig. 4 by the directions in which the test and comparison beams strike and leave the test and comparison samples respectively. For each of the operations there are several applications, a number of which are listed in Table II. The table also gives data of assistance in arranging the parts of a multipurpose reflectometer for operation and lists the primary and working standards for each operation.

As an example of the manner in which data may be taken and reduced to the values desired, Table III demonstrating the measurement of the apparent reflectivity for blue light ("paper brightness") of four samples of paper, has been included.

Each of the four samples consisted of at least ten sheets of paper making a stack thick enough to elimi-

TABLE III.—FORM SHOWING THE MEASUREMENT OF THE APPARENT REFLECTANCE FOR BLUE LIGHT ("PAPER BRIGHTNESS") OF FOUR SAMPLES OF PAPER.

Samples—Four book papers.
Purpose—To find apparent reflectivity for blue light ("paper brightness").
Working standard—Vitrolite No. 1, Assigned $A_{45°,0°(blue\ light)}$ = 0.894.

Specimen	Standard	No. 1	No. 2	No. 3	No. 4
Settings	0.894	0.756	0.743	0.701	0.544
....	....	.754	.739	.702	.542
....	....	.754	.740	.700	.540
....	....	.755	.740	.698	.544
....	.892	.754	.740	.697	.543
....	.892	.741	.720	.695	.543
....	....	.743	.718	.697	.545
....	....	.741	.721	.696	.543
....	....	.744	.720	.697	.543
....	.891	.740	.723	.695	.543
Mean	.8922	.7482	.7304	.6978	.5430
Scale correction....	+.0002	+.0026	+.0023	+.0011	—.0025
Corrected mean....	.8924	.7508	.7327	.6989	.5405
"Brightness" = corrected mean × .894 ÷ .8924	....	.752	.734	.700	.541

TABLE II.—THE MEASURING OPERATIONS OF THE MULTIPURPOSE REFLECTOMETER, SOME APPLICATIONS OF EACH, ARRANGEMENTS FOR OPERATION, AND THE STANDARDS USED

Quantity measured	Applications (The references are to papers illustrating each type of measurement, not in the majority of cases to use of the multipurpose reflectometer.)	Arrangements for operation					Standards	
		Position of sample	Scale used	Comparison surface	Gloss aperture	Spectral filters	Primary	Working
Luminous apparent reflectance, $A_{45°,0°}$.	To test paints, etc., for compliance with $A_{45°,0°}$ specifications*(5)*. To measure opacity and hiding power*(18)*. To measure cleaning power of soaps and detergents*(2)*. To determine lightness of surfaces (for Munsell value)*(7)*. To measure $A_{45°,0°}$ of blacks*(8)*.	Reflectance	Reflectance	Aluminum mirror	Large ...	Luminosity (green); (none with Photox cell)	MgO	White, gray, or black porcelain-enamel or other ceramic surface
Tristimulus colorimetry (of surfaces), $A_{45°,0°}$, through three filters	To furnish trichromatic coefficients*(12)*. To measure amount and indicate character of color differences*(10, 12, 19)*. To measure whiteness, yellowing, fading, bleaching, amount of bluing, tinting strength, etc.*(23)*.	... do ...	... do ...	.... do	... do ...	Green, blue, and amber tristimulus filters	... do ...	Porcelain-enamel or other ceramic surface similar in color and spectral character to samples
Abridged spectrophotometry (of surfaces), $A_{45°,0°}$, through filters	To supply approximate spectral-reflection curves*(15)*. To supply apparent reflectances for selected wave lengths; for example, "paper brightness" is $A_{45°,0°}$ when Lambda is approximately 458mμ for an opaque layer of paper*(3)*.	... do ...	... do ...	.... do	... do ...	Selected filters transmitting narrow spectral bands	... do ...	Ceramic plaque of known spectral 45°, 0° apparent reflectance
Specular gloss, $G_{s(45°)}$	To indicate shininess of surfaces*(9)*. To furnish a measure of the resistance of surfaces to abrasion, acid attack, weathering, wear, etc.*(21)*. To classify paints and other materials for gloss*(13)*.	Gloss	Gloss	Black plaque.	Small	Luminosity (green)	Perfect mirror .	Polished black glass or surface of liquid of known refractive index
Contrast gloss, $\frac{A_{45°,-45°}}{A_{45°,0°}}$	To determine the glossiness of surfaces of low gloss*(9)*. To measure papers for power to produce glare*(17)*.	Reflectance	Gloss or reflectance	None	Large ...	..... do	Mirror ...	Matte surface measured on goniophotometer
Bloom, $A_{45°,-45°\pm\delta}$ ..	To measure the bloom of surfaces of high gloss*(20)*.	Gloss	Gloss	Black plaque.	Special ..	..... do	Perfect mirror .	Polished surface of opaque white glass
Sheen, $G_{s(45°)}$	To measure sheen, or the shininess of surfaces at near-grazing angles*(14)*.	On special attachment	... do ...	Gray plaque..	Small	..... do	... do ...	Polished black glass or surface of liquid.
Transmission ..	To measure luminous transmissions*(6)*. To measure abridged spectral transmissions*(4)*. To furnish trichromatic coefficients for transmitting specimens *(12)* To supply data for chemical analyses ("chemical colorimetry") *(4, 22)*.	... do ...	... do ...	Light-gray plaque	Large ...	All filters (Choice depends on use)	Air, or solvent in cell	Air, solvent in cell, standard solution, or spectral filter of known spectral transmission

nate loss of light by penetration through the sample during exposure; the reflectance of such a specimen is taken as the reflectivity of the material. To obtain a result representative of each sample, a separate sheet was exposed at the top of each stack for each of the ten settings on that sample. For each sample also the first five settings were made with the incident light along the machine direction of the papers and the last five settings were made with the paper samples turned so that the incident light was across the machine direction. It will be seen that the apparent reflectances of Samples 1 and 2 changed when the papers were turned, but those of Samples 3 and 4 did not.

For each mean of ten settings the scale correction was read from the calibration curve of the instrument (*11* p. 601 and *11a*, p. 548). After the small corrections for scale error were made, the resultant values were adjusted by the factor which brought the corrected mean for the standard to its assigned value. The resulting apparent reflectivities for blue light are considered somewhat uncertain in the third decimal because of uncertainties of the value assigned the standard and of the measuring method.

By using proper standard and applying corrections for scale errors, accurate results are given by the multipurpose reflectometer. In addition, the instrument is frequently useful for merely comparing similar specimens for apparent reflectance, color, gloss or other quality, and for these comparisons no standard or calibration curve is necessary.

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Rosin–Size Precipitation and Its Effect on the Sizing and Strength Properties of Paper*

By W. P. Dohne[1] and C. E. Libby[2]

Abstract

Rosin-size precipitation was studied with particular reference to pH conditions and their effect on the sizing quality, physical strength, and stability of handmade papers.

High-free rosin size employed in a beater furnish made up with fresh water gave satisfactory sizing up to a beater pH of 7.97 when sodium aluminate and alum were employed as the precipitating agents. The same size in a beater furnish containing recirculated white water gave satisfactory sizing up to a beater pH of 5.90 when precipitated with these same chemicals.

Low-free rosin size employed in a beater furnish made up with fresh water gave hard-sized papers up to a beater pH of 8.50 when sodium aluminate and alum were employed as the precipitating agents. The same size in a beater furnish containing recirculated white water gave satisfactory sizing up to a beater pH of 6.00 when precipitated in the same manner.

The use of sodium aluminate in precipitating low-free rosin size at a pH of 6.00 required definite ratios of aluminate and alum to obtain complete precipitation of the size. Simultaneously increasing the amounts of alum and aluminate, thereby bringing about a corresponding increase in alumina, produced no effect on the sizing quality of the manufactured papers.

High-free rosin size required a minimum of 0.10 pound of alum per pound of size to produce good sizing effects. Additional quantities of alum caused a slight decrease in the sizing quality of the manufactured papers.

Low-free rosin size required a minimum of 0.40 pound of alum per pound of size to produce good sizing resistance. Additional quantities of alum caused a slight increase in the sizing quality of the manufactured papers.

Sizing precipitated with combinations of sodium aluminate and alum imparted to paper appreciably

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greater bursting strength, folding endurance, and lesser tearing resistance than did sizing precipitated with alum alone.

Papers containing aluminate-precipitated size exhibited only slight losses in physical strength when subjected to an accelerated aging test. Papers which had been sized with rosin and alum showed large losses in physical strength after similar treatment.

The accelerated aging test for loss of physical qualities resulted in progressive betterment of the size test even up to exposures of 150 hours. Both the aluminate- and alum-precipitated sizings increased in quality at an equal rate under this treatment.

Deterioration of sizing quality was studied by exposing samples of the sized papers to the action of ultraviolet light. Both the aluminate- and alum-precipitated sizings decreased in quality, the sizing precipitated at a low pH value showing deterioration more quickly than that prepared near neutrality, but thereafter proceeding to disintegrate at approximately equal rates as a result of the light treatment.

The precipitation of rosin size has been studied by many investigators and the variety of results obtained and conclusions reached from these studies are almost as numerous as the investigators themselves. The objective of the series of experiments the results of which are reported in this paper was to examine critically several of the variables which are inherent to size precipitation methods and to determine the specific effect of these variables on the efficiency of the process and the quality of the products manufactured.

Rosin size is most commonly precipitated with aluminum sulphate [$Al_2(SO_4)_3.18H_2O$] and the optimum conditions are generally considered to be in the pH range 4.2 to 5.6. In recent years, however, several researchers have proved that there are distinct advantages in precipitating size at the higher pH values and an alkaline precipitating agent, sodium aluminate ($Na_2Al_2O_4$) has come into quite general use, particularly in mills manufacturing high quality writing papers and in others that have experienced difficulties in the application of orthodox sizing processes. Major emphasis in this investigation was given to a comparison of these acid and alkaline processes of size precipitation and their respective effects on the sizing quality, physical strength, and stability of the papers experimentally produced.

Healy *(1)* claims to have first formally introduced sodium aluminate to the paper trade as a chemical aid in sizing paper at the higher pH values at the Annual Meeting of The Technical Association of the Pulp and Paper Industry in February, 1933. It is known, however, that this compound was used for this purpose many years previous to this date because a patent was issued to DeCew *(2)* in 1919 covering the use of aluminate in sizing applications.

Whatever theory one accepts as the chemistry of rosin-size precipitation, practice confirms that the aluminum ion or alumina is an essential part of the process and also that this alumina must be in excess of that theoretically required for simple reaction with sodium resinate to produce an insoluble aluminum resinate. In theory only 0.6% aluminum sulphate is required with a 2% rosin furnish to interact and produce insoluble aluminum resinate. In practice, however, this amount is not nearly enough for satisfactory results for about 1.5 pounds of alum to each pound of rosin equivalent of the rosin size is necessary to secure proper sizing. The addition of the requisite amount of alum to secure good sizing reduces the pH value to somewhere around 4.5 to 5.0 which indicates considerable acidity. Undoubtedly this acid plays an important role in sizing, perhaps in controlling the potential of the electric charges among the components of the system water-fiber-rosin and precipitant.

In sizing with sodium aluminate, it is possible to add the required amount of colloidal alumina in an alkaline combination as distinguished from acid combination. By varying the proportions of alum and sodium aluminate it is possible to secure any desired pH value and amount of alumina.

Sodium aluminate is the opposite of alum in that it is alumina combined with alkali; whereas, alum is alumina combined with acid, and therefore it reacts with alum to form alumina.

Sodium aluminate contains aluminum in the negative instead of in the positive radical. Theoretically, based on respective Na_2O and SO_3 content, one pound of aluminate will neutralize 1.23 pounds of alum and there will be provided alumina equivalent to 4.47 pounds of alum. On the basis of alumina content, a pound of sodium aluminate is equivalent to somewhat more than 3 pounds of alum. Used in conjunction with alum, sodium aluminate provides additional alumina which helps directly in cementing the rosin to the fiber and simultaneously provides a convenient method to control pH conditions, which is an important function in the manufacture of many grades of paper.

Preparation of Raw Materials

In order to insure the reproducibility of results and to eliminate as many of the variables as possible, pure abietic acid, dry rosin size, high-grade alpha pulp, C.P. aluminum sulphate, gelatin, and sodium aluminate were used throughout this investigation. The pulp used was Solka No. 1 Alpha, obtained from the Brown Company, Berlin, New Hampshire. Pure abietic acid crystals were prepared from rosin. The rosin was heated under reflux with glacial acetic acid, allowed to crystallize, washed and then recrystallized from alcohol until the acid number approached the theoretical value (i.e., 185.6).

The methods of high-free rosin size manufacture, pulp processing, sheet formation, pressing, and drying were similar to those developed by Dennett and Libby *(3)*.

In the initial studies suspensions of 100% free rosin size were used as the sizing agent. These suspensions were made with a gelatin solution and employing a Manton-Gaulin colloid mill of laboratory size. The size suspensions were prepared by making a 2.5% suspension of 60-mesh abietic acid in a 0.5% gelatin solution and running it through the mill. The particle size determinations of the abietic acid sols were made by the use of a Leitz slit ultramicroscope of latest design.

A 1.5 pound beater of the type used in making pulp strength tests by the TAPPI standard method was employed in the beating and sizing operation. The sheets were made on a British standard sheet machine which had been equipped with a sump large enough to hold the drainage or white water from one sheet. This water was recirculated back to the sheet mold by means of a small bronze gear pump. In this manner the same white water was used in the manufacture of every sheet for a given test. Also, in couching the sheets, felts soaked in white water were used instead of blotters to insure as little removal of rosin from the sheet as possible.

The papers were dried at 115 deg. C. for one hour in a Freas electric oven which was thermostatically controlled. Circulation was obtained in the oven by means of a small fan mounted on the inside wall and driven by a small motor mounted on the outside. This arrangement insured a uniform temperature throughout the oven.

The sizing values were obtained by the use of both the Valley and Cobb size testers. The Valley tester was run in the standard way. When testing a paper the time was noted in number of seconds required to attain a current flow of 160 ma. The Cobb test was run for a period of 2 minutes, and therefore indicated the water absorbed by 100 sq. cm. of paper in that time. Before testing, all papers were allowed to condition overnight in the constant temperature room of 65% relative humidity and 70 deg. F.

The amount of rosin retained in the finished papers was determined by the method of Launer *(4)* using an extraction solution consisting of 4 cc. of concentrated hydrochloric acid to one liter of ethyl alcohol.

TABLE I.—ALUM STUDIES EMPLOYING HIGH-FREE ROSIN SIZE

Alum on Pulp, %	Beater pH	White Water pH	Drainage Time, seconds	Valley Size Test, seconds
0.25	4.40	6.20	48	33.0
0.50	3.90	5.87	42	34.4
0.75	3.69	5.00	39	34.8
1.00	3.68	4.33	42	31.7
2.00	3.55	4.05	45	30.9
3.00	3.44	3.80	37	29.8
4.00	3.45	3.77	38	32.9
5.00	3.36	3.68	47	30.8

CONSTANTS

Free rosin in size, %	100.0
Rosin size on pulp, %	2.5
Rosin particle size, radius in millimicrons	258.0

Alum Precipitation of High-Free Rosin Size

It is known that in commercial practice the alum requirement of a high-free rosin size is less than that needed by a low-free rosin size or a size cooked with small quantities of sodium carbonate in the conventional way. Using high-free rosin size which was manufactured as previously described, the percentage of alum added to the pulp was varied over a wide range in an effort to determine the minimum requirement of such a size in order to secure good sizing. The results are given in Table I, and indicate that when using 2.5% of a high-free rosin size. 0.25% of alum is necessary to promote drainage and secure good sizing. Increasing the amount of alum to 5.0% with a corresponding change in white water from pH 6.20 to 3.68 showed a slight drop in the sizing test.

The effect of excessive amounts of alum on the sizing of paper is a highly controversial topic in the pulp and paper industry. Statements in the literature by Olsen and Gortner *(5)* and others indicate that when the system becomes too highly positive due to excessive alum, sizing values drop considerably. These observations are not corroborated by the present series of experiments because only a very slight decrease in the size test was noted.

In commercial practice approximately 1.5 pounds

TABLE II.—ALUM STUDIES EMPLOYING LOW-FREE ROSIN SIZE

Alum on Pulp, %	Beater pH	White Water pH	Freeness, cc.	Cobb Size Test, seconds
0.50	5.55	6.75	350	0.550
0.60	5.00	6.40	350	0.435
0.75	4.75	6.35	340	0.210
0.88	4.35	4.45	390	0.185
3.00	4.00	4.30	290	0.175
3.75	3.60	3.85	355	0.175
35.0	3.25	3.40	440	0.155

CONSTANTS

Free rosin in size, %	10.0
Rosin size on pulp, %	2.0

TABLE III.—PRECIPITATION OF HIGH-FREE ROSIN SIZE AT VARYING pH VALUES

Alum on Pulp, %	Beater pH	White Water pH	Drainage Time, seconds	Valley Size Test, seconds
3.00	3.98	5.38	41	21.2
2.50	4.38	6.40	52	23.1
2.00	5.43	6.68	50	25.5
1.50	6.66	7.17	65	28.0
1.35	7.18	7.22	63	30.7
1.25	7.45	7.40	57	33.1
1.13	7.75	7.63	73	32.0
1.00	7.97	7.80	58	30.4
0.88	8.05	7.80	79	22.9
0.50	8.32	8.02	95	14.3
0.00	9.07	8.85	75	1.5

CONSTANTS

Sodium aluminate on pulp, %	1.0
Free rosin in size, %	100.0
Rosin size on pulp, %	2.5
Rosin particle size, radius in millimicrons	410.0

of alum per pound of size are necessary to secure satisfactory sizing. This investigation indicated that when high-free rosin size was employed, 0.10 pound of alum to each pound of rosin size was sufficient to give good sizing.

Alum Precipitation of Low-Free Rosin Size

In this investigation a study was made to determine the minimum alum requirements of a low-free rosin size containing approximately 10% free rosin. The alum requirements of this size were well exceeded in an effort to ascertain the effects produced by excessive acidity. The conditions employed and the results obtained are summarized in Table II.

The results of this study indicate that sufficient alum was required to give a beater pH of 4.5 to secure good sizing. These pH conditions required 0.8% of alum on the weight of pulp showing that 0.4 pounds of alum per pound of rosin size was the minimum requirement. Larger additions of alum resulted in a definite, although moderate, increase in the size test.

In the previous investigation it was noted that excess alum caused a slight reduction in sizing quality. These divergent results would seem to indicate that the mechanism of precipitating high- and low-free rosin sizes may be different. Perhaps these findings may explain some of the conflicting opinions prevalent in the industry relative to the effects of excessive acidity on the sizing quality of paper.

High-Free Rosin Size Precipitations with Alum-Aluminate Combinations

A study was made of the precipitation of high-free rosin size by means of combinations of alum and sodium aluminate. To determine the most effective combination of alum and aluminate a series of tests were made using a constant quantity of aluminate, 1.0%, and varying the amount of alum. The beater was furnished with 2.5% of a high-free rosin size on the weight of pulp. The results of this study are summarized in Table III.

By this method it was possible to vary the pH of the beater from an acid condition, pH 3.98, to one of considerable alkalinity, pH 9.07. The best results were obtained when 1.0% of sodium aluminate was used with 1.25% of alum which corresponds to a beater pH of 7.45. From these results it must be concluded that with a constant addition of 1.0% sodium aluminate, the Valley size test increases as the quantity of alum increases to the point where 1.25% of alum has been used. Beyond this point the size test tends to fall slightly.

Influence of White-Water Recirculation on Alum-Aluminate Precipitation of High-Free Rosin Size

It is known that paper mills employing sodium

aluminate sometimes encounter sizing difficulties after operating for a certain length of time. These mills usually employ closed white-water systems and in order to duplicate this condition on a laboratory scale a special procedure was developed. In the first experiment sheets were made in the regular way. The beater was made up with 19.5 liters of distilled water and after the addition and processing of the pulp the size, aluminate, and alum were added. The pulp and water were then separated and the white water was used to recirculate in the sheet machine as usual. The white water was then removed from the sheet machine and used to charge the beater in the second experiment. The white water in the second experiment was used as dilution water to the beater for the third experiment and so on. The white water which was not recovered was made up by small additions of distilled water. All other constants were held rigid and this method would seem to approach continuous paper mill operation. These findings are shown in Table IV.

These data indicate that when high-free rosin size was precipitated with equal quantities of alum and sodium aluminate, the Valley size test decreased with each beater run if the white water from one run was used as dilution water to the beater for the following run. These results showed, that when operating at a beater pH of 8.40, the alkalinity was too high to maintain sizing in a continuous operation. To locate more favorable conditions for continuous operation, another series of tests was made at a lower pH but utilizing the same experimental technique. The amount of sodium aluminate was reduced to 0.5% and the alum was held constant at 1.0%. When paper was made under these conditions the Valley size test remained constant. These conditions correspond to a constant beater pH of 5.90, while in the previous series of tests, which was obviously unsatisfactory, a beater pH of 8.40 was maintained.

TABLE IV.—WHITE-WATER RECIRCULATION STUDIES EMPLOYING HIGH-FREE ROSIN SIZE

Aluminate on Pulp, %	Alum on Pulp, %	Beater pH Before Alum	Beater pH After Alum	White Water pH	White Water, liters	Distilled Water, liters	Drainage Time, seconds	Valley Size Test, seconds
1.0	1.0	9.02	8.35	8.25	0.0	19.5	40	38.1
1.0	1.0	8.98	8.43	8.22	15.5	4.0	18	32.2
1.0	1.0	8.95	8.43	8.27	15.5	4.0	15	24.4
1.0	1.0	8.90	8.42	8.22	15.5	4.0	13	20.3
1.0	1.0	8.89	8.42	8.30	15.5	4.0	12	15.1
1.0	1.0	8.86	8.40	8.26	15.5	4.0	12	10.0
0.5	1.0	8.57	5.97	6.00	0.0	19.5	28	27.8
0.5	1.0	...	5.78	6.28	16.0	3.5	24	26.1
0.5	1.0	8.48	5.87	6.33	16.0	3.5	30	28.0
0.5	1.0	8.40	5.85	6.40	16.0	3.5	25	27.7
0.5	1.0	8.45	5.93	6.48	16.0	3.5	24	28.5
0.5	1.0	8.40	5.88	6.41	16.0	3.5	22	27.0

CONSTANTS

Free rosin in size, %	100.0
Rosin size on pulp, %	2.5
Rosin particle size, radius in millimicrons	410.0

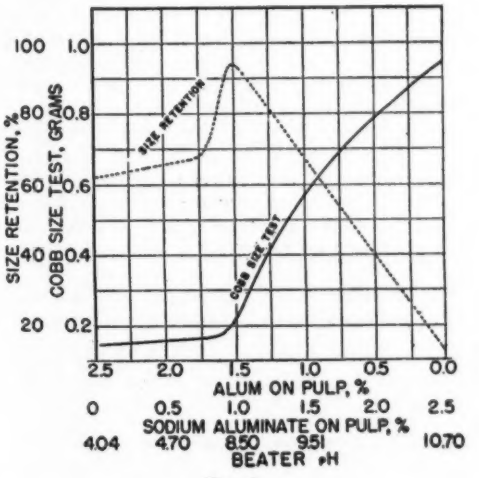

FIG. 1

Low-Free Rosin Size Precipitation with Alum-Aluminate Combinations —Constant on Pulp: 2% Low-Free Rosin Size

Low-Free Rosin Size Precipitation with Alum-Aluminate Combinations

A dry rosin size containing approximately 10% free rosin was used in this and the following series of studies. An investigation was made to determine the effect of decreasing the amount of alum used while simultaneously increasing the addition of sodium aluminate. These changes were observed by testing the manufactured papers for sizing quality and percentage of size retained. These data should indicate the highest pH which could be employed and still maintain good sizing with the alum-aluminate method of precipitation. The beater was furnished with 2.0% of dry rosin size. The results of this study are shown in Fig. 1.

As the amount of alum decreased the pH of the beater advanced from 4.04 to 10.70. The sizing of the papers increased and reached a maximum at a combination of 1.0% sodium aluminate and 1.5% of alum, corresponding to a beater pH of 8.50. Beyond this point sizing decreased rapidly. Increased amounts of aluminate with decreased alum additions gave an increase in size retention which exhibited a maximum at 1.0% aluminate and 1.5% alum. Beyond this point size retention dropped simultaneously with the size test.

TABLE V.—WHITE-WATER RECIRCULATION STUDIES EMPLOYING LOW-FREE ROSIN SIZE

Beater pH	White Water pH	Drainage Time, seconds	Freeness, cc.	Distilled Water, liters	White Water, liters	Basis Weight, pounds	Cobb Test, grams	Valley Size Test, seconds	Size Retention, %
1.5% of Alum and 1.0% Aluminate									
8.73	7.38	20	290	20	0	42.0	0.188	41	94.2
8.78	7.80	20	320	3	17	43.0	0.222	40	101.4
9.77	8.15	21	320	3	17	43.4	0.247	30	95.9
8.64	7.80	18	325	3	17	45.1	0.309	23	102.9
8.60	7.95	18	330	3	17	44.2	0.376	16	84.2
1.6% of Alum and 0.9% Aluminate									
8.18	7.25	19	290	20	0	43.0	0.197	37	80.7
8.22	7.30	18	295	3	17	43.4	0.199	45	94.5
8.24	7.20	19	305	3	17	43.0	0.202	45	88.4
8.07	7.24	30	215	3	17	43.4	0.218	30	97.8
8.14	7.05	14	325	3	17	42.6	0.200	39	85.2
1.7% Alum and 0.8% Aluminate									
6.95	7.40	12	275	20	0	45.8	0.183	32	...
7.12	7.19	15	265	5	15	46.0	0.188	33	...
7.12	7.28	13	280	3	17	45.4	0.196	29	...
7.10	7.13	13	290	3	17	45.8	0.193	31	...
7.15	7.20	13	285	3	17	44.7	0.199	29	...
1.8% Alum and 0.7% Aluminate									
5.98	7.00	11	270	20	0	46.2	0.168	36	66.1
6.08	7.10	11	255	3	17	46.2	0.172	33	74.0
6.08	6.20	10	280	3	17	45.8	0.163	35	74.4
5.92	6.60	11	280	3	17	46.0	0.171	32	77.7
6.00	6.50	10	280	3	17	46.2	0.166	30	75.6
1.9% Alum and 0.6% Aluminate									
5.28	6.40	10	280	20	0	46.4	0.159	35	...
5.14	6.60	10	280	3	17	46.8	0.161	37	...
5.13	6.57	10	285	3	17	46.2	0.170	34	...
5.11	5.94	11	280	3	17	46.2	0.168	33	...
5.08	5.95	10	295	3	17	46.4	0.167	32	...

CONSTANTS

Free rosin in size, %	10.0
Rosin size on pulp, %	2.0

Influence of White-Water Recirculation on Alum-Aluminate Precipitation of Low-Free Rosin Size

In this series of tests an investigation was made to determine the conditions which could be employed continuously in operation to manufacture satisfactorily sized papers using dry rosin size, sodium aluminate, and alum. The technique used was the same as that described for the development of the data in the study of the effect of recirculation of white water when sizing with high-free rosin size. Two per cent of dry rosin size on the pulp was employed in the beater. The conditions employed and data developed are given in Table V.

These data indicate that each time the white water was re-used, when 1.5% of alum and 1.0% of aluminate were employed, there was a drop in sizing as indicated by the Valley, the Cobb, and the size retention tests.

When more alum and less aluminate were employed—e.g., 1.6% alum and 0.9% aluminate, there was again a drop in sizing as shown by the Cobb size test. The effect here was not as great as when 1.5% of alum and 1.0% of aluminate were used, indicating that the slight reduction of aluminate was an improvement. With a combination of still more alum and less aluminate—e.g., 1.7% alum and 0.8% of aluminate, the data indicate only a slight loss in sizing with the re-use of the white water as shown by the Cobb size test.

The combination of 1.8% alum and 0.7% aluminate showed no noticeable change with the re-use of white water. This was the first condition under which complete stability of the size test was maintained. This combination of alum and aluminate corresponded to a beater pH of 6.00 and a white water slightly on the acid side or just below a pH of 7.0. The pH of the white water as given here would compare to the tray water on a typical Fourdrinier paper machine. Complete stability of sizing was shown by the Cobb test and also by the size retention test. The slight variations observed were considered within the limits of experimental error.

To prove further that this was a satisfactory zone of pH for continuous satisfactory operation, a furnish of 1.9% alum and 0.6% aluminate was tried out. This, too, appeared to be satisfactory as there was practically no change in the Cobb test. This condition corresponded to a beater pH of 5.10 and a white water pH of 6.40.

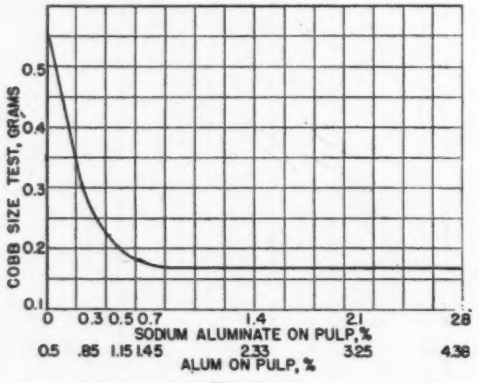

FIG. 2

Influence of Alumina on the Sizing Quality Imparted to Paper

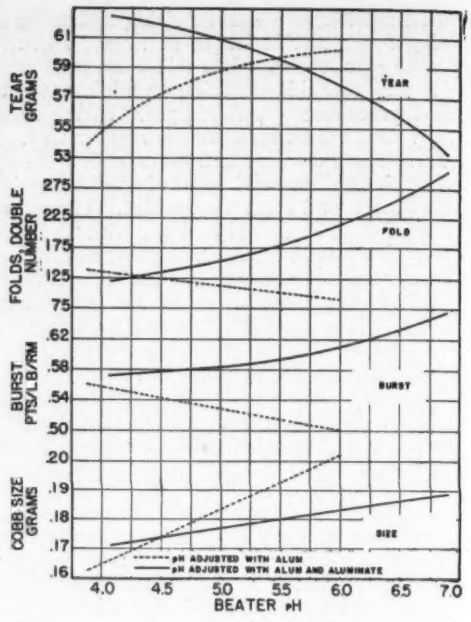

FIG. 3

Influence of Beater pH on the Sizing and Strength Qualities of Paper

Influence of Alumina on Sizing Quality of Paper

In the previous studies a beater pH of 6.0, corresponding to a tray water pH of approximately 7.0, was found to be the most favorable condition of operation when employing sodium aluminate as one of the precipitating agents. These conditions were obtained by using 1.8% of alum with 0.7% of sodium aluminate. The present series of tests was made to determine the effect on the sizing when the ratio of alum and aluminate was varied to give the same pH conditions. In other words, this study should indicate a minimum quantity of these chemicals necessary to satisfactorily precipitate the rosin size. As the ratio of these two materials increased, the effect of an excess of alumina could be observed. Two per cent of dry rosin size on the pulp was employed in the beater and the data developed are shown in Fig. 2.

These data indicate that unsatisfactory sizing resulted when alum alone was used to precipitate the rosin size at a beater pH of 6.0. This unsatisfactory sizing was due, no doubt, to an insufficient amount of alumina. With the same pH conditions, obtained by combinations of alum and aluminate, satisfactory sizing was attained. With 2.0% of dry rosin size, the data indicate that 0.7% of the aluminate and 1.45% of alum were necessary to get complete precipitation of the size. Increasing amounts of alum and aluminate, causing a corresponding increase in alumina, showed no effect on the sizing quality of the papers.

Effect of Beater pH on Sizing and Strength Characteristics Imparted to Paper[3]

The objective of this study was to determine the influence of the pH existing in the pulp beater at the time of size precipitation on the sizing results and strength characteristics of the manufactured paper.

[3] An investigation conducted for the Atlantic Refining Company, Philadelphia, Pa., at the New York State College of Forestry, Syracuse, N. Y.

A total of 2.0% size on the pulp was used throughout this study. The sizing agent consisted of 70% dry rosin size and 30% of a wax emulsion.

Two series of tests were made. In one series the pH of the beater was adjusted with alum alone, while in the other a combination of alum and sodium aluminate was employed. The data developed in this study are shown in Fig. 3.

When using combinations of alum and aluminate, good sizing was maintained even to the point of neutrality. When employing alum alone to adjust the pH of the beater, the sizing quality dropped very rapidly when an attempt was made to size paper above the pH values normally employed (4.2 to 5.2 pH).

The method of size precipitation had a marked effect on the bursting strengtth of the resulting papers. In the case of alum-sized papers the burst decreased with increasing pH, showing a loss of 10.7% in going from 4.0 to pH 6.0. With alum-aluminate-sized papers, the burst increased 15.0% over the range 4.0 to pH 7.0.

The folding endurance of the resulting papers was considerably influenced by the method of size precipitation. At a pH of 4.0 the aluminate-containing paper had a folding endurance almost identical with the alum-sized sheets. In the case of alum-sized papers, the fold decreased with increasing pH, showing a loss of 35.7% in going from pH 4.0 to pH 6.0. With the aluminate-sized papers, the fold increased with increasing pH, showing an improvement of 154.0% over the range 4.0 to pH 7.0.

The tearing resistance of alum-prepared papers increased with increasing pH, while the aluminate papers lost strength with increasing pH. The alum-prepared papers showed an increase of 12.2% in tearing resistance over the pH range 4.0 to 6.0; the aluminate papers showed a loss of 14.4% in tear over the pH range 4.0 to 7.0.

The increase in bursting strength and folding endurance of the aluminate-content papers over the alum-sized sheets is pronounced and its importance should be emphasized.

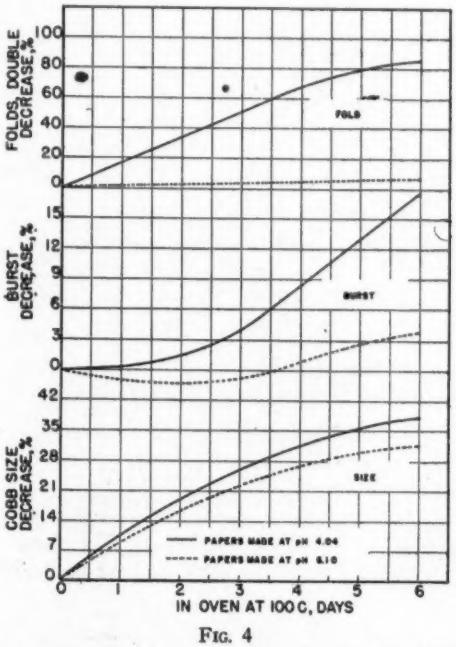

FIG. 4
Effect of Oven Ageing on Physical Properties of Papers Sized at Different pH Values

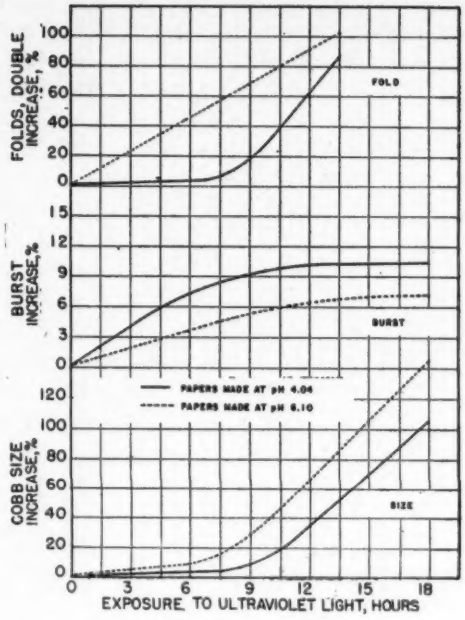

FIG. 5
Effect of Ultraviolet Light on Physical Properties of Papers Sized at Different pH Values

Accelerated Aging of Papers Manufactured by the Alum and Aluminate Methods of Size Precipitation

It is a well-known fact that the pH of a paper greatly influences the chemical and physical changes resulting from aging. The authors have been unable to locate in the literature any data showing the effect of aging upon the sizing quality of papers. A series of experiments were conducted, therefore, to learn the influence of aging upon the sizing of papers manufactured at different degrees of acidity. A determination also was made of the changes in physical strength of these papers after aging.

Studies on accelerated aging by the National Bureau of Standards *(6)* show that an accelerated aging test which determines the effect of a 72-hour heat treatment at 100 deg. C. on various physical and chemical properties arrange the papers in about the same order of stability that would be expected on natural aging. This heat treatment was employed and therefore considered comparable to the natural aging of papers. The aging of the papers was further investigated by exposure to the ultraviolet light rays produced by an Atlas Fade-Ometer.

In this investigation the two forementioned aging tests were conducted on papers manufactured at two different pH values. One set of papers contained 2.0% of dry rosin size and 2.5% of alum corresponding to a beater pH of 4.04; the other set of sheets contained 2.0% of dry rosin size, 0.7% sodium aluminate, and 1.8% of alum corresponding to a beater pH of 6.10.

The papers were first conditioned overnight at 65% relative humidity and 70 deg. F. and then tested. They were then given the aging treatment which was

followed by reconditioning overnight and then retesting. The results of these treatments are shown in Figs. 4 and 5.

Oven Aging

The oven aging of the two papers manufactured at pH 4.04 and pH 6.10 both showed gradual decreases in the Cobb size test values thereby indicating increasing size fastness. Paper manufactured at pH 4.04 showed a final increase in sizing value amounting to a 39% gain for the 6-day testing period. Paper made at pH 6.10 indicated a 31% increase in sizing value during a similar testing period.

The oven aging of papers manufactured at a pH 4.04 gave a gradual decrease in bursting strength amount to a loss of 17.7% for the 6-day period; papers made at pH 6.10 showed only a 3.7% drop in strength for a similar treatment.

Papers manufactured at high acidity, pH 4.04, gave a gradual decrease in folding endurance amounting to a loss of 85.0% for the 6-day oven treatment; papers made at low acidity, pH 6.10, showed only a 6.0% drop in folding endurance after an identical treatment.

Ultraviolet Light Treatment

The ultraviolet light treatment of all papers tested showed little change in size test until after eight hours' exposure. Beyond this point the size test increased rapidly. Papers manufactured at pH 4.04 showed a final increase of 108% in Cobb size test, while papers made at pH 6.10 gave an increase of 141%.

Papers manufactured at pH 4.04 increased 11.0% in the burst test after exposure to ultraviolet light for 18 hours; papers made at pH 6.10 advanced 7.4% in the burst test for an identical period of treatment.

The treatment of papers made at pH 4.04 showed a slight increase in folding endurance for short periods of exposure. After an 8-hour exposure time the folding endurance increased rapidly, resulting in an increase of 95.0% for the 14-hour period; papers made under less acid conditions, pH 6.10, gave gradual increase in folding endurance resulting in an advance of 103.0% for a similar period of exposure.

Conclusions

This investigation shows that the composition of a rosin size should be considered in determining the method of precipitation to secure optimum sizing effects. Excessive acidity appears to impair the quality of high-free rosin sizes and improve the quality of neutral sizes. However, these facts must be considered with due regard to machine operating conditions.

The nature of the white-water system has an important bearing on the efficiency of any sizing process. Evidence produced by this investigation leads to the conclusion that deterioration of sizing will take place more quickly in a closed white-water system when sizing near neutrality than under conditions of considerable acidity.

Highly saponified sizes require appreciably more alumina for satisfactory sizing results than high-free rosin sizes. Results of these studies indicate an alum requirement approximately four times as great for a 10% free rosin size as for a 100% free rosin size. Because a size of this high-free rosin content is never attained in commercial practice, a smaller differential in the alum requirement for commercial sizes may be expected.

This investigation confirmed the findings of previous investigators that papers manufactured under conditions of low acidity are considerably stronger in physical properties and more resistant to the deteriorating effects of aging than are papers made at the lower pH values.

A result of this research was the development of a laboratory method for determining the stability of rosin-sized papers and the development of data indicating greater resistance to aging for paper sizing which had been precipitated at higher pH values in comparison with sizing precipitated under conditions of high acidity.

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2. DeCew, U. S. 1,300,357 (April 15, 1919).
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5. Olsen, S. R., and Gortner, R. A., "The Rosin Sizing of Paper" *Tech. Assoc. Papers* 12: 112-120 (June, 1939).
6. Rasch, R. H., "Accelerated Aging Test for Paper." *J. Research Natl. Bur. Standards* Vol. 7 (Sept., 1931).

TAPPI Testing Division Reorganization

To simplify and improve the operation of the Testing Division of the Technical Association of the Pulp and Paper Industry the following committees have been established and their specific scopes defined:

Paper Testing Committee: B. W. Scribner, National Bureau of Standards, Washington, D. C., Chairman. (The methods of evaluating the physical properties (except optical properties) of paper and paperboard.)

Pulp Testing Committee: W. O. Hisey, New York State College of Forestry, Syracuse, N. Y., Chairman. (The methods of evaluating the physical properties of all pulps used for the manufacture of paper and paperboard.)

Fibrous Materials Testing Committee: B. E. Lauer, North Carolina State College, Raleigh, N. C., Chairman. (The methods of evaluating the physical properties of all fibrous raw materials (except pulp) used for the manufacture of paper and paperboard.)

Chemical Methods Committee: B. L. Browning, Institute of Paper Chemistry, Appleton, Wis., Chairman. (The chemical methods of testing paper, pulp, wood and other fibrous raw materials.)

Microscopy Committee: F. W. Bentzen, Kimberly-Clark Corporation, Neenah, Wis., Chairman. (The microscopical methods applicable to fibrous and nonfibrous materials.)

Optical Properties Committee: M. N. Davis, Kimberly-Clark Corporation, Neenah, Wis. (The methods of evaluating the optical properties of fibrous and nonfibrous materials.)

Nonfibrous Materials Testing Committee: W. F. Hathaway, Kalamazoo Vegetable Parchment Company, Kalamazoo, Mich., Chairman. (The physical and chemical methods of evaluating nonfibrous raw materials and operating supplies such as dyes, fillers, chemicals, wires, felts, etc.)

James d'A. Clark of the Institute of Paper Chemistry, Appleton, Wisconsin, is General Chairman of the Testing Division.

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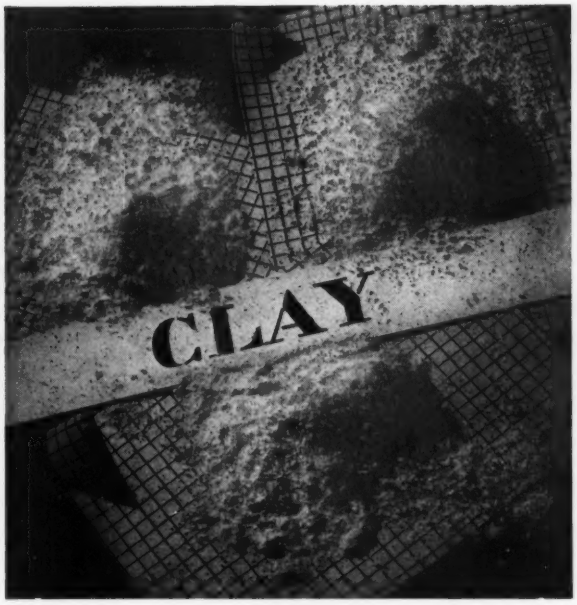

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Effective September 30, 1939, under Treasury Decision 49,970, all publications, exchanges and trade associations were denied access to import manifests at the New York Customs House. The Paper Trade Journal and other interested parties have vigorously protested this ruling, and as soon as the order of the Treasury Department is modified or rescinded, full publication of all manifests will be resumed in these columns. In the interim, the Paper Trade Journal is making every possible effort to gather all available information from manifests, at various outside sources.

NEW YORK IMPORTS

WEEK ENDING NOVEMBER 22, 1941

SUMMARY

Newsprint .....15,455 rolls

NEWSPRINT

———, ———, Cornerbrook, 4,174 rolls.
H. G. Craig Co., Inc., ———, Donnacona, 287 rolls.
———, ———, Comeau Bay, 7,277 rolls
H. G. Craig Co., Inc., ———, Donnacona, 331 rolls.
International Paper Co., ———, Gatineau, 307 rolls.
H. G. Craig Co., Inc., ———, Donnacona, 332 rolls.
———, ———, Liverpool, N. S., 2,433 rolls.
International Paper Co., ———, Gatineau, 314 rolls.

RAGS, BAGGINGS, ETC.

———, ———, Cristobal, 138 bls. cotton waste.
C. Comiter, ———, Bombay, 215 bls. cotton waste.
———, ———, Bombay, 15 bls. rags, 9 bls. hose, 25 bls. canvas cuttings.
Camden Fibre Mills, ———, Bombay, 100 bls. cotton waste.
W. Intner, ———, Bombay, 200 bls. cotton waste.
Green Textile Associates, ———, Bombay, 260 bls. cotton waste.
New England Waste Co., ———, Bombay, 200 bls. cotton waste.
Padawer Co., ———, Bombay, 150 bls. cotton waste.
Royal Mfg. Co., ———, Bombay, 100 bls. cotton waste.
C. H. Powell Co., ———, Bombay, 120 bls. cotton waste.
Lazar Szbrynski, ———, Vera Cruz, 1 ble. rags.
Atlas Waste Mfg. Co., ———, Havana, 26 bls. cotton sweepings.
S. Godfrey, ———, Montevideo, 15 bls. waste.
L. Tuloni & Son, Inc., ———, Buenos Aires, 9 bls. rags.
———, ———, Buenos Aires, 50 bls. cellulose.
———, ———, Buenos Aires, 140 bls. cotton linters.

GLUESTOCK, ETC.

J. Corvers, ———, Callao, 14 bls. gluestock.
Milligan & Higgins Corp., ———, Havana, 105 bls. fleshings.
Credo Commodities Co., ———, Buenos Aires, 200 bags animal glue.

CASEIN

Transatlantic Animal By-Products Corp., ———, Buenos Aires, 417 bags.
A. Hurst & Co., ———, Buenos Aires, 417 bags, (ground).
J. H. Schroeder Banking Corp., ———, Buenos Aires, 951 bags, (lactic).
American British Chemical Supplies, ———, Buenos Aires, 1,251 bags, (ground).
T. M. Duche & Sons, Inc., ———, Buenos Aires, 417 bags, (ground).
National City Bank, ———, Buenos Aires, 417 bags, (rennet).
Nicola Maffia, ———, Buenos Aires, 167 bags, (ground lactic), 10,000 kilos.

Issues Defense Poster

The National Association of Waste Material Dealers, Inc. has issued a defense poster which emphasizes the part which the industry should play in the cause of National defense.

The first issue of this poster which has been made possible through the generosity of interested and patriotic members of the association will be comprised of 20,000 copies. It will be sent immediately to some 16,000 to 18,000 individual units in the industry and additional distribution will be obtained through the cooperation of members of the association who will supplement the distribution work done by the Organization itself.

The outstanding feature of the poster so far as the message which it conveys is concerned is the phrase "Deliver More Now" and "Defense Production Depends on You". The poster also lists the six branches of the Industry namely: Scrap Metals, Scrap Iron, Scrap Rubber, Woolen Rags, Waste Paper and Cotton Rags.

The first poster off of the presses was sent to the President of the United States who has shown from the outset of the present emergency a keen interest in everything having to do with the possibility of increasing the collection and utilization of waste or secondary raw materials. At the association's recent convention in San Francisco a letter was read from the President indicating his interest and emphasizing the importance of waste material collections.

In getting out these posters the National Association of Waste Material Dealers, Inc. is timing it to fit in with the extensive campaign along the same lines being organized by the Bureau of Industrial Conservation of OPM.

Abitibi Earnings Up in October

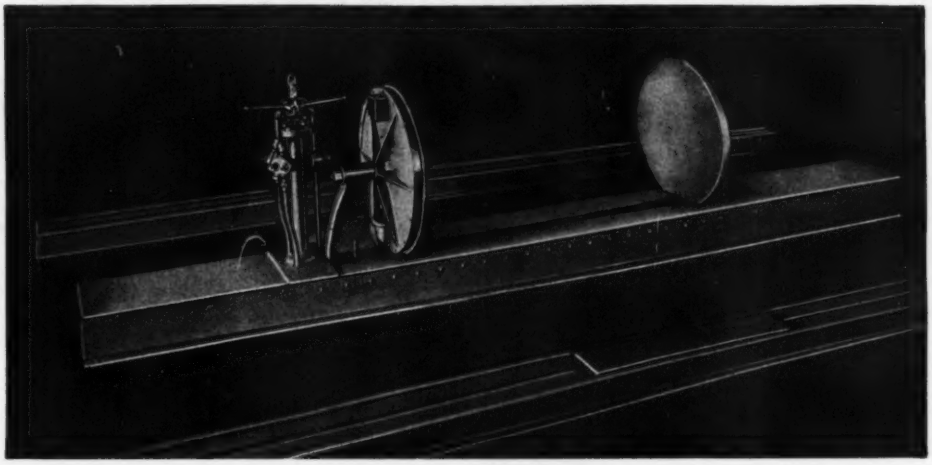
TORONTO, Ont., November 24, 1941—Earnings of the Abitibi Power and Paper Company for the month of October, 1941, prior to audit, charges for depreciation, bond interest of $283,568.63 (includes interest on overdue and unpaid interest) and income and excess profits taxes, amounted to $1,148,941, as compared with $702,459, on a similar basis, in October, 1940, and $1,087,261 in September, 1941.

Shipments of newsprint and substitute products in October, 1941, amounted to 51,489 tons, as compared with shipments of 37,210 tons of newsprint in October, 1940, and 48,472 tons of newsprint and substitute products in September, 1941.

Present indications are that shipments of newsprint and substitute products will be about 50,200 tons in November, 1941, as compared with 36,411 tons of newsprint in November, 1940.

Shipments of sulphite pulps amounted to 8,435 tons in October, 1941, as compared with 5,132 tons in October, 1940, and 8,647 tons in September, 1941. Present indications are that shipments of sulphite pulps will amount to about 8,400 tons in November, 1941, as compared with 5,985 tons in November, 1940.

W. & W. HEADING MACHINE



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New York Paper and Pulp Market Review

Heavy Demand For Paper and Paper Board Continues — No Supplies of No. 1 Kraft Pulp Now Available—Cotton Cuttings More Active This Week—Waste Paper Demand Greatly Exceeds Supply.

Office of the PAPER TRADE JOURNAL,
Wednesday, November 26, 1941.

A more steady market is reflected in reports received this week from many manufacturers' representatives, jobbers, and general paper merchants. Demand continues at a very high level under high and steadily rising general business activity. Although some of the smaller paper mills have been reported forced to curtail production through lack of pulp, and several have closed for more or less short periods, such cases have not been as numerous as many in the trade had expected earlier in the year.

The index of general business activity rose to 130.1% for the week ended November 15, from 128.3% for the previous week, compared with 114.8% for the corresponding week last year. Paper board production was 7.4% higher for the last reported week than for the corresponding week in 1940.

What affect the new price control legislation will have on future paper and pulp prices is of course highly speculative. Paper and pulp would obviously be included in any complete price control plan and maximum prices would be established. The regular bill drawn by the House, is less drastic and therefore viewed as less effective in preventing sharp price advances, than many consider necessary to prevent severe inflation. The Gore bill, however, would more completely cover all prices. Mr. Baruch recommended last week that price control should cover everything. The Administration has been opposed to fixing wages and Congress has never favorably considered control of the prices of agricultural products. Wider and tighter control of most if not all prices appears a definite possibility in the future.

The current price trend in paper, as in practically all other products, is upward, under the pressure of heavy and insistent demand. The latest Givernment paper bids opened at a higher level. From some quarters reports indicate consumer complaints of inability to obtain some specialty papers. In general, however, distribution of paper has been widely made and a number of large private consumers have commented favorably upon the efforts of both manufacturers and dealers to allot shipments on as equitable a basis as practicable.

Paper production for the week ended November 15 was estimated at 106.5%, compared with 84.7% for 1940, with 99.2% for 1939, with 81.6% for 1938, and with 62.5% for the corresponding week for 1937.

Paper board production for the week ended November 15 was 99.0%, compared with 77.0% for 1940, with 83.0% for 1939, with 67.0% for 1938, and with 56.0% for the corresponding week in 1937.

No important change in the average representative market quotations in paper has been reported this week. All paper prices are firm and shipments continue to be delayed by the heavy volume of orders.

Chemical Pulp

Demand continues heavy for all major grades of chemical pulp. Standard and ordinary grades are reported in adequate supply to meet reasonable requirements. The situation in the higher or special grades of pulp is tighter at this date. All prices are markedly firm, with some advances reported on the higher grades of domestic and Canadian kraft pulp, currently quoted at 4.00.

Substitution of the more plentiful lower grades for higher grades of pulp is likely to continue on a larger scale and be accelerated by the recent restricted allotments of chlorine to the industry by OPM.

Rags

Demand is reported quite active on new white rags, with mill buying broader at this date. Prices are firm, with expectation in some quarters of relatively small increases in the quotations of new white cuttings.

The pending order to fix maximum prices on roofing rags is reported to have slowed down trading in these grades.

Old Rope and Bagging

Old rope prices continue firmly maintained and unchanged, no important change in the market situation has been reported this week.

No change from limited activity for bagging has been reported at this date. Prices are of a nominal nature on domestic gunny.

Old Waste Paper

Mill demand for waste paper continues heavy, with supplies of the higher grades reported more difficult to obtain. If the heavy demand continues, some curtailment in the production of paper board is expected. OPA maximum prices are being well maintained.

Twine

The twine market is active. Prices on all grades of twine are firmly maintained. Orders for holiday trade were reported at a new high record this year.

Sweden Makes Less Newsprint

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., November 19, 1941—Newsprint production in Sweden dropped during the first half of 1941 as compared to the same period of last year, and an even more severe drop in newsprint exports was recorded the Department of Commerce reveals.

The recent arrival in Sweden of a few vessels from the United States was a badly-needed encouragement to the local paper industry, which has suffered considerably from the lack of shipping to western points, as compared to former times.

While kraft paper producers are in a somewhat better position due to the demand for paper twines and paper yarns for textile purposes, the operating rate of Swedish paper mills continues in a very unsatisfactory condition, the report explained, especially in the newsprint and sulphite mills.

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A partnership organized to purchase all kinds of paper job lots, seconds and side runs for resale in both domestic and export markets.

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ZOPAQUE RG

Pure TiO_2

This grade of TiO_2 shows highest developments of aqueous dispersion and suspension yet attained.

"We appreciate the patience and cooperation of our customers during this period when our production is being pushed to capacity."

Sole Selling Agents:
The Chemical & Pigment Company
Baltimore, Md. · Collinsville, Ill. · Oakland, Calif.
Manufactured by
American Zirconium Corporation
Baltimore, Maryland

· TEALE · *Flexible* SLICE

FOR UNIFORM CALIPER and WEIGHT ACROSS MACHINE

Proven by over 60 installations on various grades and weights.

Now made for adjusting deckle widths.

Many repeat orders: 9 in one mill — 5 in another . . . and others 100% equipped with Teale Flexible Slices.

Your Inquiry Invited

Jones

E. D. JONES & SONS COMPANY
Pittsfield Massachusetts

MISCELLANEOUS MARKETS

Office of the PAPER TRADE JOURNAL,
Wednesday, November 26, 1941.

BLANC FIXE—Prices on blanc fixe are firm and unchanged and conform to prevailing market levels. The pulp is currently quoted at $40 per ton, in barrels, at works; the powder is currently quoted at $60 per ton, f.o.b., works. Demand reported good for the week.

BLEACHING POWDER—Quotations on bleaching powder are firm. Demand reported heavy for the week. Market tight. Bleaching powder is currently quoted at $2 per 100 pounds, in drums, at works.

CASEIN—Prices on casein are firm, under a good demand for the current week. Standard domestic casein, 20-30 mesh, is currently quoted at 29 cents per pound; 80-100 mesh, at 29½ cents per pound. All prices in bags, car lots. Argentina casein, 20-30 mesh, is currently offered at 22½ cents per pound. No quotations on French casein.

CAUSTIC SODA—Quotations on caustic soda are firm and continue unchanged at prevailing market prices. Demand reported active. Solid caustic soda is currently quoted at $2.30 per 100 pounds; flake and ground at $2.70 per 100 pounds, in drums, car lots, at works.

CHINA CLAY—Prices on china clay are firm and conform to prevailing market levels. Demand reported good at this date. Domestic filler clay is currently quoted at from $7.50 to $15 per ton; coating clay at from $12 to $22 per ton, at mines. Imported clay is currently offered at from $13 to $25 per long ton, ship side.

CHLORINE—Quotations on chlorine are firm and unchanged. Government demand heavy. Market under mandatory priority ruling. Chlorine is currently quoted at from $1.75 to $2 per 100 pounds, in single-unit tank cars, f.o.b., works.

ROSIN—The rosin market is reported firm for the week with prices higher on most grades. "G" gum rosin is currently quoted at $2.66 per 100 pounds, in barrels. Savannah "FF" wood rosin is currently quoted at $2.66 per 100 pounds, in barrels, New York. Seventy per cent gum rosin size is quoted at $3.11 per 100 pounds, f.o.b., works.

SALT CAKE—Prices on salt cake are firm, under a heavy demand. Domestic salt cake is currently quoted at $15 per ton, in bulk; chrome cake at $16 per ton. All prices in car lots, f.o.b., shipping point. The quotation of $16 per ton imported salt cake is nominal.

SODA ASH—Quotations on soda ash are firm and continue to conform to prevailing market levels. Demand reported heavy for the week. Prices on soda ash in car lots, per 100 pounds, are as follows: in bulk, $.90; in paper bags, $1.05; and in barrels, $1.35.

STARCH—Prices on corn starch are firm and are reported unchanged for the current week. Pearl is currently quoted at $3.10 per 100 pounds; powdered starch at $3.20 per 100 pounds. All prices in bags, car lots, f.o.b., Chicago.

SULPHATE OF ALUMINA—Quotations on sulphate of alumina are firm. Demand equal to supply for the current week. The commercial grades are currently quoted at $1.15; iron free at from $1.75 to $1.85 per 100 pounds. All prices in bags, car lots, f.o.b., works.

SULPHUR—Prices on sulphur are firm and conform to prevailing market levels. Annual contracts are currently quoted at $16 per long, f.o.b., mines. Spot and nerby car lots are quoted at $18 per ton.

TALC—Quotations on talc are firm and continue unchanged at prevailing market prices. Domestic talc is currently quoted at from $15 to $21 per ton, at mines. No quotations on imported talc.

MARKET QUOTATIONS

Paper

(Delivered New York)

News, per ton—			
Roll, contract	$50.00	@	—
Sheets	58.00	"	—
Kraft—per cwt.—Delivered Zone A			
Northern, Extra Quality	$5.25	@	$6.00
Superstandard	4.87½	"	5.25
Northern Standard Wrapping	4.50	"	5.00
Standard Wrapping	4.50	"	—
Tissues—Per Ream—Carlots			
White No. 1	1.07½	"	—
White No. 1 M. G.	.97½	"	—
White No. 1½	.85	"	—
White No. 2	.85	"	—
Anti-Tarnish M. G.	.90	"	—
Colored	1.00	"	—
Kraft	.90	"	—
Manila	.80	"	—
Unbl. Toilet, 1 M.	4.14	"	—
Bleached Toilet	5.60	"	—
Paper Towels, Per Case—			
Unbleached, Jr.	3.80	"	—
Bleached, Jr.	2.30	"	—
Manila—per cwt.—C. l. f. a.			
No. 1 Jute	8.75	@	10.75
No. 1 Manila Wrapping, 35 lb.	5.50	"	5.75
No. 2 Manila Wrapping, 35 lb.	5.25	"	5.50
Boards, per ton—			
News	*45.00	@	—
Chip	*45.00	"	—
Sgl. Mla. Lt. Chip	*60.00	"	—
White Pat. Coated	*75.00	"	—
Kraft Liners 50 lb.	*60.00	"	—
Binders Boards	*80.00	"	—

* OPA Maximum Prices.

The following are representative of distributors' resale prices:

Rag Content Bonds and Ledgers—
White, Assorted Items,
Delivered in Zone 1:

	Bonds		Ledgers	
100% Rag Ext. No. 1	$40.25 @	$47.25	$41.40 @	$48.50
100% Rag	32.20 "	37.75	33.35 "	39.25
85% Rag	.... "	....	32.20 "	37.75
75% Rag	24.75 "	29.00	25.90 "	30.50
65% Rag	.... "	....	22.80 "	27.75
50% Rag	18.70 "	22.75	19.90 "	24.25
25% Rag	16.40 "	20.00	17.55 "	21.50

Colors at $1.00 cwt. extra.

Sulphite Bonds and Ledgers—
White, Assorted Items.
Delivered in Zone 1:

	Bonds		Ledgers	
No. 1	$10.55 @	$12.75	$11.70 @	$14.25
No. 2	9.65 "	11.75	10.80 "	13.25
No. 3	9.20 "	11.25	10.35 "	12.50
No. 4	8.90 "	10.75	10.05 "	12.25

Colors $1.00 cwt. extra.

Free Sheet Book Papers—
White, Cased Paper.

Delivered in Zone 1:

No. 1 Glossy Coated	$13.65	@	$15.50
No. 2 Glossy Coated	12.40	"	14.00
No. 3 Glossy Coated	11.60	"	13.25
No. 4 Glossy Coated	11.15	"	12.75
No. 1 Antique (watermarked)	10.25	"	11.75
No. 2 Offset	9.60	"	11.00
A Grade E. F.	9.35	"	10.75
A Grade S. & S. C.	9.60	"	11.00
B Grade E. F.	8.85	"	10.25
B Grade S. & S. C.	9.10	"	10.50
C Grade E. F.	8.55	"	9.75
C Grade S. & S. C.	8.80	"	10.00
D Grade E. F.	8.25	"	9.50
D Grade S. & S. C.	8.50	"	9.75

Ivory & India at $.50 cwt. extra.

Mechanical Pulp

(On Dock, Atlantic Ports)

No. 1 Imported—			
Moist	No prices		
Dry	No prices		

(Delivered)

No. 1 Domestic and Canadian	40.00	@	42.00

Chemical Pulp

(On Dock, Atlantic, Gulf and West Coast Ports)

Bleached Sulphite (Domestic and Foreign)—			
Prime Bleached Sulphite	3.62½	@	4.75
Prime Qualities—			
Easy-Bleaching Sulphite	3.17½	"	4.25
Strong Unbleached Sulphite	3.17½	"	4.25
News Grade, delivered			
Unbleached Sulphite	63.75	"	67.75

(On Dock, Atlantic Ports)

Kraft Bleached	4.12½	"	—
Kraft Light & Strong	No price		
Kraft No. 1	No prices		

(Delivered)

Kraft Domestic and Canadian	3.00	"	4.00

(Delivered)

Soda Bleached	3.30	"	—

Add 60 cents per short ton, dock charges for Albany; $2.50 for Lake Ports East and $3.50 for Lake Ports West of Mackinac Straits.

Domestic Rags

New Rags

(Prices to Mill f. o. b. N. Y.)

Shirt Cuttings—			
New White, No. 1	8.00	@	8.25
Silesias No. 1	4.50	"	4.75
New Unbleached	8.00	"	8.25
Blue Overall	5.75	"	6.00
Fancy	3.00	"	3.25
Washables	2.50	"	2.75
Mixed Khaki Cuttings	2.50	"	2.75
O. D. Khaki Cutings	3.00	"	3.15

Old Rags

White, No. 1—			
Repacked	3.75	"	4.00
Miscellaneous	3.25	"	3.50
White, No. 2—			
Repacked	2.50	"	2.75
Miscellaneous	2.00	"	2.25
Third and Blues—			
Repacked	1.25	"	1.35
Miscellaneous	1.10	"	1.25

Roofing Rags—

No. 1	1.50	"	1.60
No. 2	1.35	"	1.50
No. 3 (bagging)	.95	"	1.00
No. 4	.90	"	.95
No. 5A	.90	"	.95

Foreign Rags

All prices nominal

New Rags

New Dark Cuttings	2.25	@	2.40
New Mixed Cuttings	2.00	"	2.20
New Light Silesias	5.50	"	5.75
Light Flannelettes	5.50	"	5.75
New White Cuttings	7.00	"	7.50
New Light Oxfords	4.00	"	4.50
New Light Prints	3.00	"	3.25

Old Rags

No. 1 White Linens	7.50	"	8.50
No. 2 White Linens	6.50	"	7.50
No. 3 White Linens	4.50	"	—

UNITED PIGMENTS

Pure Titanium Dioxide

UNITANE·O

A brilliantly WHITE, pure, fine titanium dioxide possessing excellent . . .

- **OPACITY**
- **BRIGHTNESS**
- **DISPERSION**

Suitable for ALL types of paper ranging from thin printing papers and waxing tissues to coated book and magazine stocks.

UNITANE O—110 was especially developed for paper pigmentation. Its excellent dispersion in water promotes good retention and excellent sheet formation. As a component of the beater furnish, it produces *whiter* sheets of *great brilliance*, and superior printing qualities.

SAMPLES of UNITANE O-110 will be sent promptly upon request.

UNITED COLORS & PIGMENTS

UNITED COLOR AND PIGMENT CO.

DIVISION OF INTERCHEMICAL CORPORATION

NEWARK, NEW JERSEY

SALES OFFICES IN PRINCIPAL CITIES

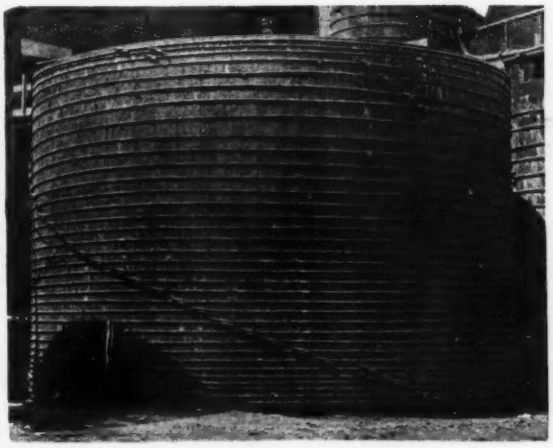
FOR OVER HALF A CENTURY . . . . .

KALAMAZOO HAS SPECIALIZED IN PAPER MILL TANKS

As a pioneer in paper mill tanks, we developed the Glazed Tile Tank which has received almost universal acceptance. More than 1,000 successful installations stand as proof of their cleanliness, long life and economy.

Here are shown three of approximately thirty tile tanks at the Kalamazoo Vegetable Parchment Company.

WOOD TANKS, ACID TANKS, BLOW PITS



If you have a tank problem, why not let the long experience of our engineering staff guide you to the right answer.

Kalamazoo

TANK AND SILO COMPANY

KALAMAZOO, MICHIGAN

Established 1887

No. 4 White Linens.	2.25	@	3.25
No. 1 White Cotton.	4.25	"	4.75
No. 2 White Cotton.	3.25	"	3.75
No. 3 White Cotton.	2.50	"	3.00
No. 4 White Cotton.	1.90	"	2.20
Extra Light Prints..	2.00	"	2.40
Ord. Light Prints...	1.75	"	2.15
Med. Light Prints...	1.55	"	1.95
Dutch Blue Cottons.	2.25	"	2.50
French Blue Linens.	3.00	"	—
Checks and Blues...	2.08	"	—
Linsey Garments....	1.90	"	2.00
Dark Cottons.....	1.50	"	1.60
Old Shopperies.....	1.30	"	1.45
New Shopperies.....	1.45	"	1.50
French Blues.....	2.25	"	2.50

Old Rope and Bagging

(Prices to Mill, f. o. b. N. Y.)

Gunny No. 1—			
Foreign	Nominal		
Domestic	4.00	@	4.25
Wool Tares, light....	4.25	"	4.50
Wool Tares heavy..	4.50	"	4.75
Bright Bagging.....	3.50	"	3.75
Manila Rope			
Foreign	6.50	"	6.75
Domestic	6.50	"	6.75
Jute Threads.....	4.00	"	4.25
Sisal Strings.....	2.75	"	3.00
Mixed Strings.....	1.10	"	1.20

Old Waste Papers

(F. o. b. New York)

OPA Maximum Prices

No. 1 Hard White Envelope Cuts, one cut	3.37½ @	—
No. 1 Hard Colored Envelope Cuts....	3.12½ "	—
No. 1 Hard White Shavings, unruled.	2.87½ "	—
No. 1 Hard White Shavings, ruled...	2.50 "	—
Soft White Shavings, one cut.....	2.87½ "	—
No. 1 Soft White Shavings	2.50 "	—
Soft White Shavings, Misc.	2.15 "	—
No. 1 Fly Leaf Shavings	1.67½ "	—
No. 2 Fly Leaf Shavings	1.12½ "	—
No. 1 Groundwood Fly Leaf Shavings	1.25 "	—
No. 2 Mixed Groundwood Fly Leaf Shavings	.90 "	—
Mixed Colored Shavings	.75 "	—
Mixed Groundwood Colored Shavings..	.90 "	—
Overissue Magazines	1.67½ "	—
No. 1 Heavy Books & Magazines.....	1.57 "	—
Mixed Books.....	1.07½ "	—
No. 1 White Ledger	2.17½ "	—
No. 2 Mixed Ledger, colored	1.87½ "	—
New Manila Envelope Cuttings, one cut..	2.87½ "	—
New Manila Envelope Cuttings	2.65 "	—
Extra Manilas.....	1.85 "	—
Mixed Kraft, Env. & Bag Cuttings	2.75 "	—
Kraft Envelope Cuttings	3.25 "	—
Triple Sorted, No. 1 Brown Soft Kraft.	2.50 "	—
No. 1 Assorted Old Kraft	1.75 "	—
Old Kraft Corrugated Containers	1.35 "	—
New Corrugated Cuttings	.90 "	—
Old Corrugated Containers	.82½ "	—
Box Board Cuttings.	.72½ "	—
White Blank News.	1.65 "	—
Overissue News.....	.85 "	—
No. 1 Baled News..	.75 "	—
Super Mixed Paper..	.70 "	—
No. 1 Mixed Paper.	.65 "	—

Twines

(F. o. b. Mill)

(Soft Fiber)

Coarse Polished—			
India	.21	@	—
White Hemp.....	.21	"	—
Fine Polished—			
Fine India.....	.26	"	—
Unpolished—			
Box	.17¼	"	—
Paper Makers.....	.17	"	—
Tube Rope.....	.19	"	—
Wall Paper.....	.20½	"	—
Wrapping	.23	"	—
Soft Fiber Rope...	.19	"	—
Cotton	.25	"	—
(Hard Fiber)			
Medium Java.....	.18	"	—
Mex. Sisal.....	.16	"	—
Manila	.26	"	—

PHILADELPHIA

Domestic Rags (New)

(Price to Mill, f. o. b. Phila.)

Shirt Cuttings—			
New White No. 1.	.07¼ @	.07½	
New White No. 2.	.04½ "	.05	
Light Silesias.....	.04½ "	.04¾	
Silesias, No. 1....	.04 "	.04¼	
Black Silesias, soft	.03¾ "	.04	
New Unbleached..	.07¾ "	.07½	
Washable Prints...	.03¾ "	.03½	
Washable No. 1..	.02 "	.02¼	
Blue Overall.....	.04½ "	.05½	
Cottons—According to grades—			
Washable shredding	— "	.01¾	
Fancy Percales....	.03¾ "	.03½	
New Black Soft...	.02¾ "	.03	
New Dark Seconds	1.75 "	2.00	
Khaki Cuttings—			
No. 1 O. D.....	.03 "	.03¼	
No. 2 Mixed.....	.02¼ "	.02½	
Corduroy	.01¾ "	.02¼	
New Canvas.....	.04¾ "	.05½	
New Black Mixed.	— "	.02½	

Domestic Rags (Old)

White No. 1—			
Repacked	3.25	@	3.75
Miscellaneous	3.00	"	3.25
Thirds and Blues—			
Miscellaneous	2.00	"	2.25
Repacked	2.25	"	2.50
Black Stockings (Export)	Nominal		
Roofing Stock—			
Foreign No. 1....	Nominal		
Domestic No. 1...	1.95	"	2.00
Domestic No. 2...	1.80	"	1.85
Roofing Bagging..	1.70	"	1.75

Bagging

(F. o. b. Phila.)

Gunny, No. 1—			
Foreign	Nominal		
Domestic	3.25	"	3.50
Manila Rope.....	5.00	"	5.50
Sisal Rope.....	3.75	"	—
Mixed Rope.....	.75	"	1.00
Scrap—			
No. 1.....	3.75	"	4.00
No. 2.....	1.75	"	1.80
Wool Tares, heavy...	4.00	"	4.25
No. 1 New Light Burlap	3.00	"	4.00
New Burlap Cuttings	3.75	"	4.00

Old Papers

(F. o. b. Phila.)

OPA Maximum Prices

No. 1 Hard White Envelope Cuts, one cut	3.37½ "	—
No. 1 Hard White Shavings, unruled.	2.87½ "	—
Soft White Shavings, one cut.....	2.87½ "	—
White Blank News..	1.65 "	—
Soft White Shavings, Misc.	2.15 "	—
No. 1 White Ledger.	2.17½ "	—
No. 2 Ledger, colored	1.87½ "	—
No. 1 Heavy Books & Magazines.....	1.57 "	—
Overissue Magazines	1.67½ "	—
New Manila Envelope Cuttings	2.65 "	—
No. 1 Assorted Old Kraft	1.75 "	—
No. 1 Mixed Paper.	.65 "	—
Super Mixed Paper..	.70 "	—
Box Board Cuttings.	.72½ "	—
New Corrugated Cuttings	.90 "	—
Overissue News.....	.85 "	—
No. 1 Baled News...	.75 "	—

BOSTON

Old Papers

(F. o. b. Boston)

OPA Maximum Prices

No. 1 Hard White Shavings, unruled.	2.87½ "	—
No. 1 Hard White Shavings, ruled...	2.50 "	—
Soft White Shavings, Misc.	2.15 "	—
No. 1 Fly Leaf Shavings	1.67½ "	—
No. 2 Fly Leaf Shavings	1.12½ "	—
No. 1 Groundwood Fly Leaf Shavings	1.25 "	—
No. 2 Groundwood Fly Leaf Shavings	.90 "	—
Mixed Colored Shavings	.75 "	—
New Manila Envelope Cuts, one cut.....	2.87½ "	—
Hard White Envelope Cuts, one cut.....	3.37½ "	—
Triple Sorted No. 1 Brown Soft Kraft.	2.50 "	—
Mixed Kraft Env. & Bag Cuttings.....	2.75 "	—
Kraft Envelope Cuttings	3.25 "	—
No. 1 Heavy Books & Magazines.....	1.57 "	—
New Manila Envelope Cuts, one cut.....	2.87½ "	—
New Manila Envelope Cuttings	2.65 "	—
White Blank News..	1.65 "	—
No. 1 Assorted Old Kraft	1.75 "	—
No. 1 Mixed Paper.	.65 "	—
Super Mixed Paper.	.70 "	—
Overissue News.....	.85 "	—
Box Board Cuttings.	.72½ "	—
Old Kraft Corrugated Containers	1.35 "	—
Old Corrugated Containers	.82½ "	—
New Corrugated Cuttings	.90 "	—

Bagging

(F. o. b. Boston)

Gunny Bagging—			
Foreign	(nominal)		
Domestic	4.50	@	4.75
Sisal Rope.....	4.00	"	4.25
Mixed Rope.....	1.00	"	1.25
Transmission Rope—			
Foreign	(nominal)		
Domestic	2.75	"	3.00
Soft Jute Rope.....	5.00	"	5.50
Manila Rope—			
Foreign .....(nominal)			
Domestic	6.50	@	6.75
Jute Carpet Threads.	5.00	"	5.25
Bleachery Burlap....	7.50	"	8.00
Scrap Burlap—			
Foreign	(nominal)		
Domestic	6.50	"	6.75
Scrap Sisal.....	3.25	"	3.50
Scrap Sisal for Shredding	4.00	"	4.25
Wool Tares—			
Foreign	(nominal)		
Domestic	5.00	"	5.50
Aust. Wool Pouches.	5.25	"	5.50
New Burlap Cuttings	5.75	"	6.00
Heavy baling bagging	4.75	"	5.00
Paper Mill Bagging..	3.25	"	3.50
No. 2 Bagging.....	.50	"	.60

Domestic Rags (New)

(F. o. b. Boston)

Shirt Cuttings—			
New Light Prints.	.04½ @	.04¾	
Fancy Percales....	.04¾ "	.05	
New White No. 1.	.07¾ "	.08	
New Light Flannelettes	.06 "	.06¼	
Canton Flannel, Bleached	.08¾ "	.08½	
Underwear Cutters, Bleached	.08½ "	.08¾	
Silesias No. 1.....	.04½ "	.05	
New Black Silesias..	.34½ "	.04½	
Red Cotton Cuttings	.03½ "	.04	
Soft Unbleached....	.08½ "	.08¾	
Blue Cheviots....	.04¾ "	.05	
Fancy	.01¾ "	.02	
Washable	.01¾ "	—	
Cottons—According to Grades—			
Blue Overalls.....	.06 "	.06¼	
New Black, Soft..	.03¾ "	.04	
Khaki Cuttings.....	.02¼ "	.02¾	
O. D. Khaki	.02½ "	.03¼	
Corduroy	.02 "	.02¾	
New Canvas.....	.05½ "	—	
B. V. D. Cuttings...	.07¾ "	.08	

Domestic Rags (Old)

(F. o. b. Boston)

White No. 1—			
Repacked	4.00	@	—
Miscellaneous	3.00	"	—
White No. 2—			
Miscellaneous	2.50	"	3.00
Twos and Blues.....	1.75	"	2.00
Old Blue Overalls...	2.25	"	2.50
Thirds and Blues....	1.75	"	—
Miscellaneous	1.25	"	1.35
Black Stockings.....	3.50	"	4.00
Roofing Stock—			
No. 1.....	1.80	"	—
No. 2.....	1.60	"	—
No. 3.....	1.50	"	—

Foreign Rags

(F. o. b. Boston)

Canvas .....(nominal)	
Dark Cottons.....(nominal)	
Dutch Blues.....(nominal)	
New Checks and Blues(nominal)	
Old Fustians.....(nominal)	
Old Linsey Garments.(nominal)	
New Silesias.....(nominal)	

CHICAGO

Waste Paper

(F. o. b. Chicago)

OPA Maximum Prices.

Shavings—		
No. 1 Hard White Envelope Cuts, one cut	3.37½ "	—
No. 1 Hard White Shavings, unruled.	2.87½ "	—
No. 1 Soft White Shavings	2.50 "	—
No. 1 White Ledger	2.17½ "	—
No. 1 Heavy Books & Magazines.....	1.57 "	—
White Blank News..	1.65 "	—
Mixed Kraft Env. & Bag Cuttings..	2.75 "	—
No. 1 Assorted Old Kraft	1.75 "	—
Overissue News.....	.85 "	—
No. 1 Baled News..	.75 "	—
No. 1 Mixed Paper..	.65 "	—

Invincible Tool Attachments

Invincible tool attachments are applicable to all types of machine repairs and are manufactured by the Invincible Tool Company, 914 Citizens Trust Building, Fort Wayne, Ind. The complete line of the company includes angle tool attachments for a wide variety of uses. By the addition of these angle tools a portable drill may be converted into angle tools of almost universal application.

Invincible angle tool attachments enable the mechanic to work in difficult to reach spots, in the installation, maintenance and repair of machinery, piping, etc. These convenient tool accessories are available for drilling, reaming, lapping, nut running, counter boring, spot facing, counter sinking, screw driving, vertical and angular milling, kewaying, and for many other types of work that must be done as speedily as practicable in industrial plants to keep up production.